RAILROAD GAZETTE

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Contributions

The First Metal Cab.

574 Craig Street,
Montreal, July 4, 1900.

TO THE EDITOR OF THE RAILROAD GAZETTE.

In your issue of June 29, page 445, "Metal Versus Wooden Cabs for Locomotives," I read the following: "Mr. F. W. Mahl advises me that the first steel cab built was in 1891 on the Southern Pacific System in Arizona." This statement is, I think, incorrect. To the best of my knowledge the first steel cab put on a locomotive was built by me when I was Mechanical Superintendent of the Canadian Pacific Railway. A full description, with engravings, was given in the *National Car Builder*, June, 1889. I said at that time, "the cab is of steel plate No. 10. I. W. G. thick, etc. This is probably the first steel cab that was ever built on the continent of America." This statement was never taken into question and the cab was built fully two years before that built by the Southern Pacific. Since 1889 the Canadian Pacific Company has continued more or less to use steel cabs.

FRANCIS R. F. BROWN,
Late Mechanical Superintendent C. P. Ry.

A Voice From the Pool.

Chicago, July 9, 1900.

TO THE EDITOR OF THE RAILROAD GAZETTE.

Among topical discussions at the recent convention of the Master Mechanics' Association the question "How to Make Pooling of Locomotives a Success" was handled with soft gloves, except for one or two expressions against the idea. It is well known that pooling locomotives is usually fathered by somebody outside of and above the motive power department, in authority, before it becomes part of a railroad organization. It is equally well known to mechanical men that it represents the most beautifully rounded ideal and the most mischievous practice that was ever introduced into railroad work. It is not always politic to express these views audibly, hence these sentiments were not sent into the convention.

The gentleman who vented his disapproval of pooling, by comparing the roundhouse and its pooled engines with the livery stable and its horses, is entitled to a vote of thanks (which he did not receive) for having courage to shed the first ray of humor over the gloom of locomotive pooling. Since the matter has thus taken on the form of metaphor, may I shape it as it looks to me? I should say, then, that it is the White Elephant of American railroading, and that no mechanical "mahout" has yet been able to satisfactorily control it; that it was never really needed, and, having it, we don't know what to do with it.

It is so easy, too, to find the wrong end of the proposition. When I turn to it on the spur of some new claim in its favor, or of an old one newly garbed, the cautionary advice of David Harum's benefactor always comes before me, and I can see the child approach timorously, to feed the elephant, hearing his friend advise meanwhile, "Now be sure you find the right end of him, sonny." I can not find the right end of him. It is easy to find the wrong end, and sully an erstwhile clear mechanical record by insufficient care of engines that can not be properly cared for under the circumstances.

I have sat in the councils of the sage and responsible when engines were condemned to the pool without mercy; also, when it was found expedient to take them out again, not necessarily with mercy, but as a matter of survival. I believe I am familiar with all, or most, of the arguments pro and con; how the mileage will be greater; an engine is an engine; it needs no petting and grooming; how we will wear them out and replace them and have margins and margins of increased earnings on investment to the good beside; and then, too, how we *don't* replace them; how we run hot because of unsuspected neglect and disorder of parts, "lay out the road," lose business for the traffic department and bear the brunt of disfavor for delayed and rejected perishables, and so forth, without end, and therefore without "Amen." The opinion of locomotive engineers can be obtained without stint at any call-board or water tank caucus, and the kernel of their sentiment, more or less openly expressed, is "Let her go to hegq. I brought her through this time."

It has been shown quite clearly, time and again, that two crews, or three at most, can run an engine to death rapidly enough to satisfy the most ambitious iconoclast of any department. Couple this fact with the fact that, where only the necessary number of engines and crews are kept to cover the demand, with a reasonable reserve, an engine is always subject to call whether the man can go or not. All engines are, therefore, "pooled," and always have been, in the broadest sense; but to throw men and engines into an indiscriminate mêlée of irresponsibility for the sake of following out a fad seems to me unreasonable and therefore unbusiness-like. Inspection, in the pool, is usually a farce that would be laughable if it were not so hazardous.

On the whole, is it not the sense of motive power men, from shopman to Superintendent of Motive Power, that it is about time to cast the influence of the Master Mechanics' Association against further "monkeying with the elephant?"

DANIEL LABENBURG.

Ballast.

One of the reports to the International Railroad Congress is on ballast, the question being "Properties of good ballast; choice to be made between ballasts of different qualities, regard being paid to the character and the heaviness of the traffic, the cost, etc.: Effect of the ballast on the condition of the road." The report to which we refer is made by Mr. A. Feldpauche, Principal Assistant Engineer of the Pennsylvania Railroad, and we give an abstract of it.

It is assumed at the outset that ballast should be substantial enough to distribute the strain of passing loads upon the largest area, and it should be enduring. These conditions are best met by the use of hard, conglomerate rock broken to a suitable size. The interlocking of the fragments helps materially to distribute the load into the spaces between the ties. The hard fragments do not break up quickly under tamping and their sharp corners lock with the ties and prevent lateral displacement. Finally, the voids give excellent drainage. Ballast should be dustless and it should be somewhat elastic, and the latter condition is better met with cinder, gravel and the like than with stone.

Naturally, in a country as large as the United States there must be great variety in the material obtainable for ballast and throughout large regions gravel and broken stone are so costly that earth ballast is still used to a considerable extent.

Mr. Feldpauche gives a review of the methods of forming roadbed and of distributing ballast in the United States, with pictures of grading machines, ballast unloaders, ditchers, etc., all of which must be of interest to engineers outside of the United States who are quite unfamiliar with this sort of apparatus. He gives also drawings of standard track tools as used on the Pennsylvania Railroad and of the oil sprinkling car, with its details. Still other engravings show the machinery for breaking stone for ballast as used by contractors along the line of the Pennsylvania Railroad.

Gravel exists in abundance over a large part of the United States and is more extensively used for ballast than any other material. The quality necessarily varies, and when loam predominates the ballast is prone to retain water, increasing the cost of maintaining the track. But no gravel ballast drains as freely as stone. Moreover, it is much more dusty than stone. The cost of ballasting with gravel, of course, varies with the proximity of the supply to the place where it is to be used. As a round figure it is said that ballasting to a depth of 6 in. below the tie will cost about $580 a mile of single track. The engine, train and crew cost $15.11 a day and labor costs 11 cents an hour. The cost of train and crew includes engineman, fireman, conductor, who acts as foreman and flagman. This is based on an average haul of 30 miles and includes $320 for delivering the gravel and $260 for putting it in the track.

The Pennsylvania Railroad at one time spread a coat of cinders over the entire top of the gravel ballast on its Atlantic City, seashore line, 58 miles, in order to keep down the dust. More recently it has sprinkled that section with refuse petroleum oil, a process well known to our readers. This is a residuum after the final distillation. It costs 4 cents a gallon and takes about 2,000 gallons to the mile. The total expenditure is about $85 a mile, including train and labor. About 2,600 miles of track had been treated in this way at the time of writing this report. [Our impression is, however, that since the report was written the Pennsylvania has decided to ballast the Atlantic City line with broken stone.]

Locomotive cinders are, generally speaking, equal to, and in some respects, better than the average gravel for ballasting. They are not so dusty, they do not so much promote the growth of weeds, but they are less durable and to some degree shorten the life of ties by chemical action. They are generally preferred where they can be had in sufficient quantities, but they are much inferior to broken stone and hardly serviceable for heavy traffic. The cost of putting them in the track is about the same as gravel, but the cost of maintenance is less.

Furnace slag is largely used and the outer vitreous portions make a fairly good dustless ballast, better than gravel, but the softer portion is perishable and of little value. Here also the chemical changes tend to shorten the life of the tie.

Oyster shells are used on some seashore lines, and one line of 95 miles (the New York, Philadelphia & Norfolk) is entirely ballasted with oyster shells. These cost in track about $900 a mile. They make a dustless road, but are too light to hold the ties well in place. Furthermore, they are productive of vegetable growth.

A great deal of track has been ballasted with burnt clay, which for 20 years has been held in high favor. The most desirable quality of clay is a dense black clay known as gumbo, which burns more readily than ordinary brick clay. For preparing this a pile of old ties or other wood about 3 ft. high, 3 ft. wide and from one-half mile to a mile long is made on the land selected. Two tracks are laid parallel with this pile of wood and a short distance away from it. The front track is to haul away the burnt clay, the rear track for handling the digging machinery and for delivering and spreading the alternate layers of coal and clay on the pile. When a layer of clay has been deposited on the top and back of the woodpile the fire is started, and as soon as it breaks through the clay a thin coating of coal is added which is covered with another layer of clay about 4 in. thick. In this way layers of clay and of coal are put on as fast as the fire works through, and the operation is prolonged for about 60 days, or until the requisite amount of burnt clay is secured. About 4 cu. yds. of clay is used to one ton of coal. Steam digging machinery takes up the clay from the trench and it is deposited in small lumps on a conveyor belt extending at right angles from the car to the top of the burning pile, and so the clay is spread in place on the pile as the excavator moves forward. The track carrying this digging machinery is thrown over gradually as the pile and trench get wider. The sprinkling of the coal is done by hand from an overhanging platform secured to the car. This ballast has most of the good qualities of broken stone, but is less durable. It costs in track about 85 cents per cu. yd., 50 cents of which is cost of making.

Of course, broken stone is the best ballast known, considering all of its qualities, particularly the completeness with which it lends itself to maintaining good drainage. We omit entirely Mr. Feldpauche's description of the methods of preparing broken stone. Its cost varies a good deal, from, say 45 cents per cu. yd. for limestone to 75 cents per cu. yd. for trap. The volume of this broken stone shrinks in transit and consequently of late years it has been bought by the ton rather than by the cu. yd. Granite and trap weigh respectively 2,450 lbs. and 2,624 lbs. per cu. yd. for 2½ in. ballast. The shrinkage has been found to amount to 10 per cent. in 82 miles.

The labor cost of putting in a 2½-in. ballast in new track is about 22 cents per cu. yd. On the Pennsylvania's high-speed road between Baltimore and Washington, 35½ miles of double track was reballasted, gravel being taken out and broken stone put in, and the cost was accurately kept. The cost of this change was $5,559 per mile, the construction train charges being as quoted before and the labor being 12 cents an hour. The ballast was laid five inches under the tie. The granite and trap rock was broken to sizes varying from 2 to 3 in. and cost f. o. b. cars 68 cents per ton. It was unloaded from hopper bottom cars while in motion.

The standard 2½-in. ballast originally adopted on the Pennsylvania has been very generally adopted by the leading roads throughout the country. The size was purely arbitrary. Some experiments have recently been undertaken by the Pennsylvania Railroad Company to ascertain the best size for ballast. A comparison will be made between ¾-in. ballast and 1½-in. ballast and 2½-in. ballast (these being the limiting sizes of the broken stone). Each of these three sizes was used separately, one on each of three consecutive miles of double track between Baltimore and Washington. The first cost of each mile was correctly noted and an accurate record will be kept of the maintenance charges. The alignment and surface are kept at the same standard on all three miles.

These three sizes, as well as screenings, have been used on the lines of the Pennsylvania, and there is great diversity of opinion among those experienced in the use of these four grades of ballast as to their relative merits. Mr. Feldpauche thinks it expedient to set forth the conclusions that may be drawn from the opinions that he has gathered on this important question.

The best size of ballast is that which has the least tendency to choke with dirt and impede drainage. Screenings seem to be preferred for yard and freight tracks of secondary importance, but (principally on account of dust) are condemned for passenger tracks. This ballast, it is claimed, will shed water well. The relatively small voids are filled with dust, forming a surface over which the water readily flows off. Another advantage of this smooth surface seems to be that coal dust and other car drippings may be easily removed by the shovel. It is

claimed furthermore that as the screenings pack well around the ties the latter are held in place with less labor and furthermore, that there is greater elasticity. Finally, screenings are easily shoveled, consequently cost less to handle and less to tamp, but screenings present the corresponding disadvantages of greater liability to dust and a greater tendency to pump at imperfectly drained joints and also a greater loss of ballast from the inability to clean it when it is clogged with dirt.

The ¾-in. ballast seems to have, with one exception, all the good qualities of screenings and to excel screenings in several material respects. The exception is that it is inferior in drainage efficiency. It does not shed the water off the surface like screenings, and, on the other hand, the smaller voids make sub-draining slower than through the larger voids of coarser ballast. Just what the difference is in this respect must yet be determined by experiment. In other respects this ¾-in. ballast appears to be superior to the coarser variety. It is more elastic, more easily shoveled, cheaper to handle and easier to keep in line and surface.

Ballast of the 1½-in. size is easier to handle than the standard or 2½-in., more elastic, more suitable for surfacing. It is neat and sightly in the track. The 2½-in. ballast is strongly objected to by nearly everyone experienced in its use. While it affords the best drainage and will not clog with dirt from above or below, it seems to be generally less satisfactory from nearly every other standpoint. Of all the varieties in use it is most difficult and hence most expensive to handle. It is particularly objectionable in surfacing track. In consequence of its large size there is a constant liability to hump the track above the desired elevation. Aside from this, tamped tie bearings of these large stones frequently fail to give the desired surface and alignment. The stones can not be packed in well enough to give the requisite stability.

"In light of the foregoing considerations it is to be hoped that the experiments alluded to, supplemented by kindred investigations, will eventually disclose the size of stone best suited for ballasting purposes."

Single-Expansion Engines With Piston-Valves—State Railroad of France.*

The State Railroad Company bought, in 1897 and 1898, ten powerful engines for heavy express service, at very high speed. Six of these engines were obtained from the Alsacian Society of Mechanical Constructions, and are exact reproductions of the four-cylinder compound engines of the Northern Railroad. The other four were built by the Creusot Manufacturing Company and are single-expansion engines having piston-valves on the Ricour system, which has been long employed by the railroads of the State. The locomotives of the two types have similar boilers carrying a pressure of 213 lbs. and 200 lbs. respectively.

The compound type of the Northern Railroad Company is universally known. The State Railroad Company has benefited by the profound studies which were made of these engines, and by the large experience acquired by the Société Alsacienne in all the details of their construction. As a result the compound locomotives have behaved in a perfect manner, in the severe service required of them. For power and flexibility; for wearing qualities in service, they have proved to be all that was expected from a type so justly commended.

*An abstract from "Notes on the State Railroad's New Single Expansion Engines with Piston Valves; Results Obtained when in Use in Comparison with Compound Engines," by M. Desdoults, Engineer-in-Chief of Rolling Stock and Machinery of the State Railroad.—Revue Générale des Chemins de Fer, March (1900), pp. 191 to 199 and April, pp. 297 to 332.

The single-expansion piston-valved engines of the Creusot series, which are to be especially referred to in this article, are of the eight-wheel type. The cylinders are outside of the frames, and steam is distributed to them by a Walschaert valve gear, the action of which does not involve eccentrics. The Belpaire boiler has a deep fire-box extending down between the frames and is provided with Serve tubes. The outside form of the engines has been arranged so as to reduce as far as practical, the resistance to motion offered by the atmosphere, the front of cab, boiler, and stack being shaped or lagged to a wedge-like form.

A summary of principal dimensions is as follows:

Locomotive numbers	2751 to 2754

Grate.

Length	79.9 in.
Width	38.9 in.
Surface	21.7 sq. ft.
Inclination	8 degrees

Fire-Box (Copper.)

Inside height measured to under part of frame forward	56.7 in.
Inside height, measured to under part of frame, back	66.5 in.
Inside length, top	77.0 in.
Inside length, bottom	79.3 in.
Inside width, top	44.1 in.
Inside width, bottom	39.9 in.
Thickness of side and back sheets	0.39 in.
Thickness of tube sheet in tube region	1.18 in.
Thickness of tube sheet at its inferior part	0.39 in.

Tubes.

Type	Serve
Metal	Steel
Number	111
Exterior diameter	2.56 in.
Thickness	0.10 in.
Number of wings in each tube	8
Projection of wings	0.43 in.
Average thickness of wings	0.10 in.
Length between tube plates	141.0 in.

Heating Surface.

Firebox, above the grate	120.2 sq. ft.
Tubes, inside development	1,582.3 sq. ft.
Total	1,702.5 sq. ft.

Ratios.

Tube surface to that of firebox	13.24
Total surface to that of grate	78.65

Boiler (Steel.)

Inside diameter of shell	52 in.
Length of cylindrical portion	11.36 ft.
Thickness of sheet of the cylindrical body	0.67 in.
Interior length of smoke-box	44.3 in.
Distance from rail to the center of the boiler	7.5 ft.
Distance from rail to under part of the fire-box, forward	2.0 ft.
Minimum level of the water above top of crown sheet	6.0 in.
Volume of water space	142.7 cu. ft.
Volume of steam space	217.9 cu. ft.
Working steam pressure	200 lbs.

Stack.

Inside diameter	16.9 in.
Height above rail	14.27 ft.

Frame Plates and Wheels.

Frames.

Distance between frame plates	48.4 in.
Thickness of the frame plates	1.18 in.
Exterior length of foot plate	90.8 in.
Length of engine measured between extremity of buffers	33.75 ft.

Distance Between Axles.

1st and 2d (truck)	78.7 in
2d and 3d	100.0 in.
3d and 4th (coupled axles)	106.3 in.

Mounted Wheels and Axles.

Diameter of drivers	79.9 in.
Diameter of truck wheels	37.8 in.
Lateral play of axles in their boxes	0.08 in.
Distance between inside of tires	53.6 in.

Lateral Play of Tire Flange With Rail on Each Side of the Engine.

1st and 2d axles (truck)	0.4 in.
3d axle (main)	0.8 in.
4th axle (rear)	0.4 in.

Weights.

Empty engine	101,853 lbs.

Engine in Working Order.

1st axle (truck)	23,038 lbs.
2d axle (truck)	23,038 lbs.
3d axle (main)	32,848 lbs.
4th axle (rear)	32,848 lbs.
Total	111,772 lbs.

Mechanism.

Number of cylinders	2
Diameter of cylinder	17.3 in.
Length of stroke	25.6 in.
Clearance, per cent. of cylinder volume	8.5 in.

Motion.

Distance from center to center of cylinders	74.8 in.
Length of main rod	86.6 in.

Distribution.

Valve gear	Walschaert
Design of piston valves	Ricour
Diameter of piston valve	7.9 in.
Maximum travel of valve	5.0 in.
Outside lap	1.2 in.
Inside lap	0.07 in.

Section of Steam Passage.

Dimensions of steam ports	10.1 x 1.5 in.
Area of steam ports	15.15 sq. in.
Area of steam pipe	12.0 sq. in.
Area of exhaust passage	22.0 sq. in.

Variable Exhaust Tip.

Area of maximum opening	20.8 sq. in.
Area of minimum opening	5.3 sq. in.

Outside of the peculiarities of the exterior form, the most characteristic feature of the engines of this series, compared with those of other French railroad systems, is the piston valve. After investigations, about 1880, M. Ricour did not hesitate to adopt piston-valves for all new equipment for the State Railroad system. From 1881 to 1885, there had been put in service 60 passenger engines, 22 unclassified engines, 40 powerful freight engines and 10 light switching engines, all provided with piston valves.

These engines have been in constant service, with most satisfactory results, ever since they were received, experience suggesting no need of modification in the type of valve, either in existing engines or in those which are yet to be built.

The Piston Valve.—The construction of the valve may at first give the impression of a delicate organism; usage has removed this apprehension. The purpose underlying the design is to secure an arrangement which shall be steam tight when the engine is using steam, and which shall break the contact between the valve rings and the valve casing, when the engine is drifting with closed throttle, the condition being analogous to that of a flat valve suspended above its seat. A section of the cylinder and valve chamber is shown by Figs. 1 and 2.

The valve is composed of three principal parts, namely, an inner bushing, Fig. 6, an outer bushing, Fig. 4, and a packing ring, Fig. 3. The bushings fit one into the other, to form the body of the piston, Fig. 1. The exterior surface of the ring presents three grooves, *h*, *h*, *h*, Fig. 3. These aid in distributing lubrication, allow back pressure to be transmitted to the full circumference of the ring when the engine is running with closed throttle, and assist in making the piston steam-tight when the engine throttle is open. Inside of the ring is a thin rib *n*, Fig. 3, with perfectly surfaced faces and which slides freely between the two bushings forming the body of the piston, shown in Fig. 1. The ring is cut to form a broken joint, *ab cd*, the openings *ab*, *cd* being sufficient to allow the ring to close when subject to pressure on its exterior surface.

When the two bushings have been fitted, the one to the other, a copper gasket, Fig. 5, is inserted between them and they are pressed to place on the rod *W*, Fig. 1. This done, there remains between, a groove just wide enough to receive the rib *n*, of the packing ring which, while free to expand or contract, makes a steam-tight joint with the abutting surfaces on either side. A square projection *E*, Fig. 3, prevents the ring from rotating.

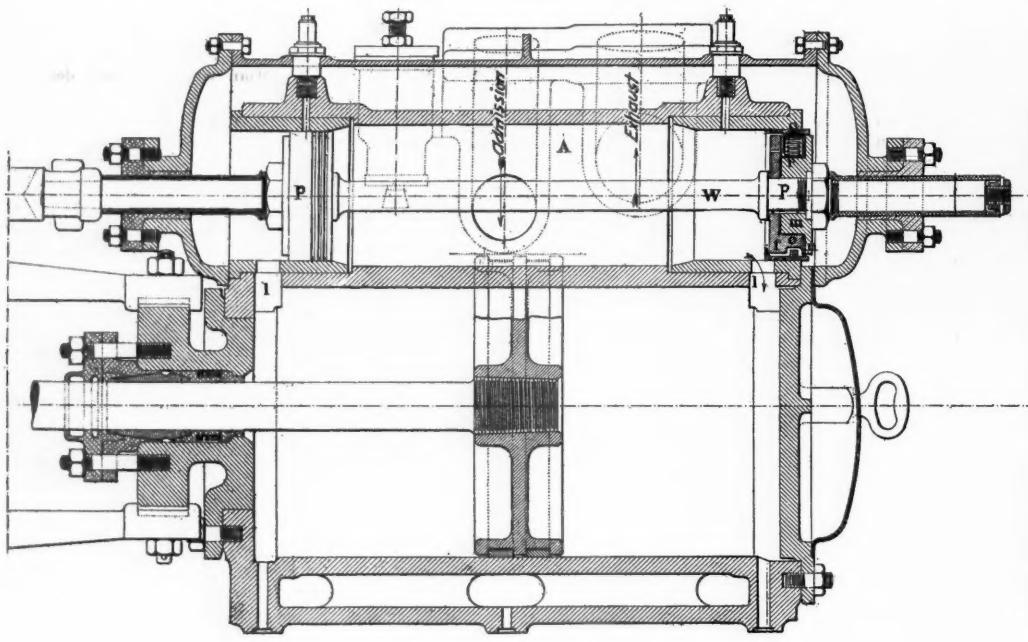


Fig. 1.

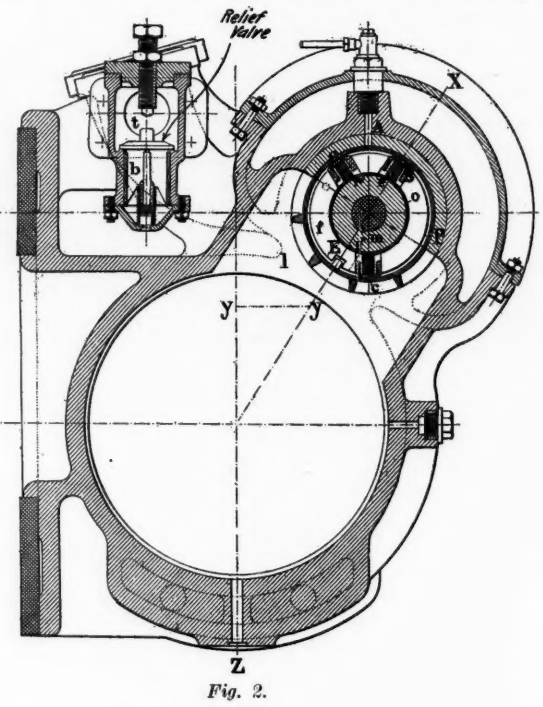


Fig. 2.

Cylinder and Piston-Valve Design—French State Railroads.

The arrangements serving to center the ring with reference to the axis of the valve chamber are described as follows: In the outer bushing there are three radial cavities into each of which is fitted a spiral spring, *r*, *r'*, *r''*, Fig. 2. Each spring carries a cap which bears against the inner surface of the packing ring. The cavity *S*, carrying the spring *r* is rectangular in section. In this is fitted a rectangular cap, Fig. 7, which serves as a cover-plate for the open joint *cd* of the packing ring, Fig. 3. The other cavities are round in section and the caps over the springs are round, performing no function except to transmit the pressure of the spring to the packing ring.

The joint in the ring at *S* and the projecting lug which prevents rotation in the ring, are at the extremities of the same diameter *X Y* of the valve which, when prolonged passes through the axis of the engine cylinder, Fig. 2.

The axis of the spring *r'* with its cap *C* forms with the vertical, the same angle as the spring *r* with its cap *S* covering the joint in packing ring. Finally, the third spring *r''* has its axis on the vertical passing through the center of the valve.

The two springs *r*, *r'* have the same tension; the third spring *r''* is so regulated as to exactly center the ring.

The ring when not subjected to pressure is a little smaller than the diameter of the chamber in which it works so that no part touches the walls of its chamber.

The three springs *r*, *r'*, *r''* are not sufficiently compressed to materially expand the ring. When subject to pressure on its exterior surface, the ring closes on itself until the edges of the joint, *ab*, *cd*, Fig. 3, touch each other. When the throttle is closed the valve works freely without contact with the walls of the chamber in which it travels. As soon as the steam is admitted to the space between the two valve-ends, it passes into the annular space *i* between the ring and the body of the valve, expanding the ring until it has contact with the walls of its chamber, and at the same time pressing the rib *n* strongly against the side of the groove in the body of the piston, so that no steam can pass either over or under the ring. The two pistons forming the complete valve, are adjusted on a common rod with a distance between them sufficient to permit the use of straight ports between the valve and the engine cylinder. Steam enters between the pistons of the valve and is exhausted past the ends.

The adoption of the piston-valve has resulted in a material reduction in cylinder clearance. This effect, while possibly of advantage for certain slow-speed stationary engines, is not sought in the case of locomotives, nor in the case of engines in general, having rapid motion and to which steam is distributed by a single valve. In such engines the presence of sufficient clearance is necessary to avoid excessive compressions which otherwise occurs when the cut-off is short. The first piston-valve engines built in which the clearance was reduced to about 2 per cent. of the volume of cylinder were soon found to have too much compression for high speeds. The defect has been corrected in part by reducing the exhaust lap of the valve and even in the adoption of negative lap. But a much more complete result has been obtained in re-establishing the cylinder clearance upon an equality with, and even superior to, that employed in connection with the plain slide-valve engines. This was accomplished for the engines already built by substituting for the parallel-faced engine-piston, a wrought piston having a single web, Fig. 1, and by inserting a liner between the ends of the cylinders and their heads.

4 Comparison of Piston-Valve Engines With D-Valve Engines.—It will be seen that piston-valves have been used for nearly 20 years, in all the new engines built for the State Railroad system. The number includes a series of passenger locomotives (Nos. 2,069 to 2,099, and 2,500 to 2,528), built after the model of a group of somewhat older engines already used by tne company, the only difference being that in the new engines the piston-valve has taken the place of the D-valve.

These two series of machines have been in continuous service in drawing ordinary passenger trains under identical conditions, making it possible to compare, under the most favorable condition from an experimental and practical point of view, the valves of the two systems of distribution.

Practice has plainly shown, for the piston valves, the following advantages:

1. Increase of Tractive Power.—In starting, the maximum pull of the piston valve engines is greater by about 10 per cent. than that of the plain valve engines, having the same diameter of wheels, same dimension of cylinders, and the same steam pressure. In the process of accelerating a train the maximum pull may be maintained for a greater length of time. This result is due to a reduction or, one might almost say, to the complete suppression of the frictional resistance inherent to the system of three port-slide-valves. The advantage exhibited in starting, exists equally and as a result of the same causes, in pulling heavy trains over grades. With a theoretical tractive force of 13,667 lbs., these engines give, at a speed of about 19 miles, an effective force of about 11,000 lbs., or more than 0.80, the value of the co-efficient of utilization. For high speeds, with steam admitted for from 20 to 30 per cent. of the stroke, these engines develop a tractive power which is correspondingly good. They stand without difficulty, with moderately loaded trains, a speed of 56 to 62 miles per hour.

2. Facility of Manipulation.—The manipulation of piston-valved engines is more easy than that of D-valved engines. The working of the reversing mechanism requires much less force. Even for the most powerful freight engines, the travel of the valve is changed or reversed by the use of one hand. The management of the fire is equally easy, because of the regular action of the draught.

3. Saving of Fuel.—The performance sheets show an average fuel consumption for the piston-valved engine which is from 2 per cent. to 3 per cent. less than that of the plain-valved engine.

4. Saving in Repairs.—The running repairs are notably diminished by the use of piston valves; the wear and tear of the valves themselves is nil, that of the valve mechanism, insignificant. The roundhouse employees who, at first, had entertained strong prejudices against this system of distribution soon became entirely favorable to it. The annual saving in maintenance has been estimated at from $40 to $60 per engine.

Comparison With Compound Engines.—As already stated, the four piston-valved engines which have been described are identical in all respects excepting as to cylinder arrangement, with the six four-cylinder compounds of the Northern Railroads type. All are employed in similar service.

As a matter of experiment, however, two of the simple engines were given a diameter of cylinder of 17.3 in. and two of 18.1 in. It was found that the larger cylinder was not advantageous and hence all comparisons are made between two simple engines and six compounds.

The engines under test were employed in the same train service, and their performance was taken from the records of the accounting office covering a period of three months. The results show that the compounds used but 1.6 per cent. less fuel, carrying but 2 per cent. more tonnage, and used 25 per cent. more oil, the speed being the same.

But a comparison of the relative value of a simple and compound locomotive should not be based upon considerations of fuel and oil consumption alone, but should take into account the first cost and the cost of maintenance of the engines involved.

The first cost for the compound engine, which takes in four complete movements and a crank axle, is necessarily higher than for the single-expansion machine. The difference has been estimated by M. Salomon, Engineer-in-chief of the Northern railroad, to be $232. Assuming that these figures may be somewhat reduced, and allowing for interest and for sinking fund, the annual cost may be taken at 58 dollars or, with a mileage of 62,000, at about 0.1 cents a mile.

The cost of fuel is practically equal for both types of machines, while that of oil is higher for the compound by about 0.13 cents a mile. The consumption of water per effective horse power under the conditions of the normal service, is about 21 pounds for both types of engines. At high speeds, from 250 to 300 revolutions, the consumption of the single-expansion engine is lowered to 20 lbs.; the locomotive under these conditions attaining a superior performance to that of the best stationary engines.

The manipulation of the single-expansion engine is more easy than that of the compound. It can be entrusted to less skilful engineers without fear of loss of efficiency through improper handling. The amount of oil is noticeably smaller for the single-expansion machine. The cost of maintaining reversing mechanism is less for the single-expansion machine than for the four-cylinder machine. The simple engine has an advantage in the absence of the crank axle. For the accomplishment of the same work, the capital invested is smaller for the single-expansion.

In conclusion, it may be said that for the service of ordinary express trains, the two types are equivalent as to work accomplished; the single-expansion having the advantage from an economical point of view.

For the service of very fast trains, the single expansion engine is superior, both as to amount of work done and as to economy in action.

For very heavy trains, or for lighter trains on grades, the compound will develop more power on a given consumption of fuel than the single-expansion engine, but with a diameter of wheel suitable to the nature of the service, the single-expansion engine may gain even this advantage.

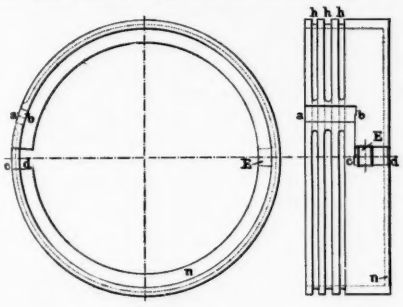


Fig. 3.

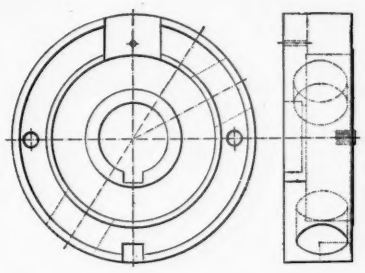


Fig. 4.

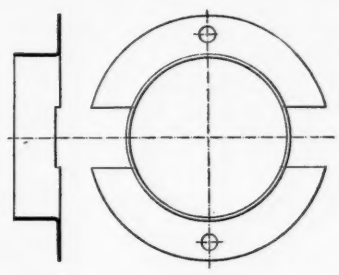


Fig. 5.

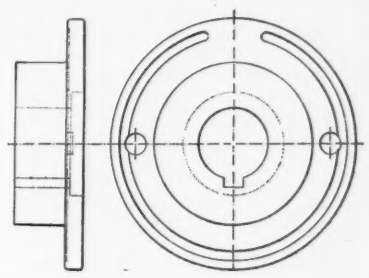


Fig. 6.

Main Details of Packing Rings for Piston-Valves.

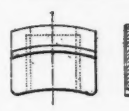


Fig. 7.

Fig. 8.

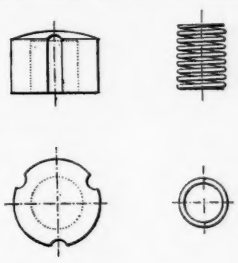


Fig. 9.

Centering Details for Packing Rings.

The Modern Engineer.*

BY JOHN FINDLEY WALLACE, PRESIDENT, AM. SOC. C. E.

The profession of Civil Engineering, as we now know it, is a child of the nineteenth century. The conception of that child, however, occurred with the earliest dawn of human history. Among the earlier engineers we find mention of Tubal Cain, who followed the mechanical branch of the profession; Noah, who devoted his attention to ship building; Joseph, who achieved great success in the construction of grain warehouses and irrigation works; the unknown Egyptian who conceived, designed and constructed the pyramids, and in whose honor, for all we know, the celebrated figure of the Sphynx may have been erected; Moses, who devoted his energies and lifetime to the transportation of a nation from one section of the globe to another, also giving some attention to hydraulics; and Joshua, who followed a similar line of work and also utilized his engineering talents in the overthrow of Jericho by means of the theory of rythmic oscillation. * * *

It has been said that the measure of civilization is the measure of success attained in the preservation of food products. It seems that the truer exponent of modern civilization is transportation; for, while the Hebrew wanderer in Egypt was able to preserve his food products for a period of seven years, and his co-workers preserved in their mummies grains of wheat, which, thousands of years afterward, were transported to the fertile fields of Oregon and have since germinated and yielded the famous Mummy Brand of wheat, for which that region is celebrated, neighboring tribes and nations starved, because the only means of transportation in those days consisted of caravans of camels by land, and the shallow vessels which navigated the Mediterranean without a compass. No one agency has been a more potent factor in the advancement of civilization than improved transportation facilities, and the profession of civil engineering has been the force which has conceived, designed and executed the works and machinery which have furnished the world with these facilities. * * * The great engineers of this century have been responsible and should receive credit for the conception, design and execution of these works, without which the Americas, Asia, Africa, Australia and the isles of the sea would still be among the uncivilized, unknown or inaccessible portions of the world. * * *

The pioneer engineers of the century were strong, rugged characters, educated in the school of adversity, who lived close to Nature's heart and were keen observers of natural phenomena. They possessed strong imaginations, daring originality, faith in their convictions. These pioneers were followed by a class of engineers who were the students of their predecessors, and who supplemented their own talents and advantages by a study of the methods and the fund of knowledge accumulated by those who lived before them. This latter class has been followed by a generation of engineers who have had the benefit of the larger fund of accumulated engineering wisdom and experience, supplemented by academic and technical education: until now, the young man choosing the engineering profession has before him opportunities, easily accessible, of acquiring the highest scientific and technical educa-

*Extracts from an address at the annual convention, London, England, July 2, 1900.

tion, and entire libraries devoted to the description and elucidation of engineering works and methods, from which to gain an accurate knowledge of the great works which have been accomplished by other members of the profession in all countries, and from which he can derive material for the formation of his own plans. From this vast storehouse of accumulated facts, easily accessible throughout the world, he should be able to steer clear of the errors and avoid the failures of older engineers, and should be able to achieve a higher measure of success. * * *

Among the underlying qualities necessary to the highest success in our profession are, the ability to accurately observe natural phenomena; a faculty of mentally picturing things in their proper relation to each other; good business judgment and sense; a careful study of business methods; tact, which to some men means so much and to others so little; personal loyalty, not only to the enterprise in which he is engaged, but also to his immediate superior; and, above all, the engineer should not neglect the fact that "The proper study of mankind is man." In the technical schools of the present day much time is spent in considering the strength of materials, the applied mathematics in the investigation of forces; but nothing in relation to the mental and moral constitution of man, which is the live material that engineers must use in fitting Nature's raw products to the work in hand. There is too much of a tendency among engineers to-day, as ever, to consider the profession entirely a materialistic one, and to confine the education of the young engineer to a knowledge of materials and their uses, to the exclusion of the mental and spiritual. * * *

The true engineer of to-day is the one who, seeing a necessity arising in the onward march of civilization, can think out its solution, conceive a project, design the necessary works connected therewith, and carry out the scheme as a whole to a successful issue; at the same time convincing his fellowmen of the necessity for the work, the efficiency and economy of his design, and his own ability to accomplish the desired result. * * *

The best engineer is not necessarily the one who will design and construct an elaborate bridge across a mighty river, but the one who will design and construct such bridge so as to give the greatest amount of facility for transportation over it at the least possible expense. I have in mind a bridge over a great stream in America, which, with its auxiliaries, was constructed some years ago at an expense approximating $10,000,000. It brought a national reputation to its engineers. I have in mind another bridge, located within five miles of the same structure, which, so far as railroad traffic is concerned, performs the same functions but cost one-tenth the amount of money. The construction of this latter bridge was a mere incident in the career of the engineers who designed and superintended the work, and it has brought practically no addition to their fame.

In comparing the works of engineers, that engineer is the best who designs and constructs, results being equal, in such a way that the interest on capital invested, together with maintenance charges and operating expenses, are a minimum. It is certainly poor engineering to construct works so massive and with such a surplus of strength and solidity that the interest on the original amount invested far exceeds the cost of repairs, renewals and interest on a differently designed work which would perform a similar service.

In this I think the engineers of the Old World can learn from those of the New. On the other hand, in the construction of works of a permanent nature, so as to reduce the cost of operation, maintenance or renewal, the New World can certainly learn from the Old. During the past century, however, the problems which have confronted the engineers of the Old and New Worlds have been vastly different. Works have been constructed in the Old World to meet existing and stable conditions; in the New World, works have been provided to create conditions; consequently, it has been necessary for engineers in the New World to have not only vivid and correct imaginations, and to be able to judge of possibilities and future requirements, but to design and construct their works in such a way as to bring about the desired results with a limited amount of labor and capital.

It has not been a question of choice between what was best or even most economical; the main question has been one of what it was possible to do under the circumstances. Frequently, it was a case of the engineer creating the circumstances. Conditions, however, are rapidly changing, and the engineer of the New World is following closely in the footsteps of the Old World engineer, and his works are gradually becoming more substantial and permanent. * * *

The point I desire to make and emphasize is the importance and responsibility of the engineering profession in relation to the advancement of civilization, and the fact that it is our duty, first, to fit ourselves as individuals in every possible way for the responsibility placed upon us, and secondly, that we should combine individual units in organization; that it is the duty of the engineer first to fit himself for his individual work, and next to combine with his fellow engineers for the strengthening and elevating of the profession.

From time to time much has been said in relation to engineering ethics, and suggestions have even been made that they be formulated. We should not forget that engineering ethics are simply business ethics, and that the foundation of all ethics is the golden rule, which we should individually endeavor to observe and practice.

This year and to-day will mark an epoch in the history of the American Society of Civil Engineers. This Society holds the same relation to America that the Institution of Civil Engineers holds to the British Empire. With grateful appreciation and profound respect we have accepted the invitation of the Institution of Civil Engineers, and hold our thirty-second annual convention in this house, the home of the greatest engineering association in the world; and we feel warmly the kindness and sympathy which this invitation implies upon the part of our elder brothers. We hope that this meeting will have the effect of not only strengthening the bonds between the different branches of the Anglo-Saxon race, to which most of our members belong, but also of strengthening the larger bond which should unite all mankind and bring about the ultimate acknowledgment of the common brotherhood of man. This grand consummation of our labors, whether we realize it or not, is the ultimate destiny of our profession.

Railroad Building in Southeastern Siberia.

The line which is to connect the Siberian Railroad proper with the Chinese Eastern Railroad, which the Russians are building, it will be no child's play to construct. The track is now laid on what the Russians call the Trans-Baikal Railroad, that is, the original line of the Siberian Railroad, as far as it is to be built, to Strjetensk, on the River Schilka, a navigable branch of the Amoor, which is about 670 miles from Lake Baikal. To find a practicable route to connect this with the Chinese border was a very difficult task, requiring two years of exploration and surveys. The point of junction finally determined upon is 535 miles east of Lake Baikal. Mr. K. Ipsberg, a Russian engineer who has been employed on the line, describes it and the country through which it passes, in an engineering journal published at Riga.

The line crosses a number of streams forming the headwaters of the Amoor, and the intervening divides which, in places, rise 4,100 ft. above sea level. It has maximum grades of 91 ft. per mile in both directions, with minimum curves of 1,030 ft. radius. On a section 20 miles long two engines will be required for every train, and the grading will be very heavy—cuts 48 ft. deep and embankments nearly twice as high, while most of the cuts are in granite or other hard rock. There will be several bridges, but none very long. The distance to the Chinese border, where the Chinese Eastern Railroad begins, is 216 miles—715 miles from Lake Baikal.

The country on the route is most desolate. On the whole 216 miles little more than a hundred acres of agricultural land were taken for right of way. The few inhabitants, Burats and Cossacks, live chiefly by grazing. Only three villages are on the route, a few others 20 to 30 miles distant. The latitude is about that of the south of England, but the climate is very severe. There are very few cloudy days, and the yearly rainfall is but 8 in., nearly all in summer; but the average temperature of the year is below freezing, and in winter for several months the thermometer ranges from 4 to 40. When a certain depth below the surface is reached the ground is found to be frozen the year round, which has a considerable effect on the cost of earthwork. In spite of the light rainfall floods damaged the work on the Trans-Baikal road to the extent of $3,500,000 before it was opened. There being scarcely any snow in winter the water passage can not be estimated by the flow of the streams in spring. The floods which did so much damage came in July and August.

Owing to the entire lack of fruit and fresh vegetables, the inhabitants suffer greatly from scurvy, and this has a great effect on the prosecution of the work. The natives can be used little except for teaming. Most of the laborers, including carpenters and masons, are brought from Russia. A considerable number of Chinese are employed, especially in brick-making and burning lime, and to some extent as stonecutters. Most of the stonecutters, however, are Italians. Many convicts and soldiers are employed also. The country supplies abundance of timber, stone and clay of very good quality, but sand is lacking, and the brick made by the Chinese, although the clay is excellent, are inferior. These materials are not very dear, but everything brought in costs enormously—Portland cement $11 per ton; lime, 75 cents per 100 lbs., etc.

The road is intended to be capable of passing three trains each way daily with a gross load of 324 tons behind the engine, on 60 axles. As a maximum, it is calculated that there may pass five trains daily, two mixed trains with an average speed of 13½ miles an hour, two freight trains at 8 miles an hour, and one construction train at 8 miles. But by putting sidings at intervals between the infrequent stations, 20 to 27 miles apart, so that trains may pass at intervals not more than 8 miles apart, it is estimated that 14 trains may pass each way daily.

The unfavorable experience with the light rails (48 lbs. per yard) on the Siberian Railroad west of Lake Baikal has led to the adoption of a heavier section on this line, namely 63 lbs. per yard. The maximum distance between water stations is 44 miles. All buildings except the main shops and roundhouse are of wood. The cost of this connecting line this engineer estimates at $68,000 per mile, which will make it the costliest division of the line except that around the south end of Lake Baikal, which need not be built for some time, as the lake ferry transfers trains.

Excavations for foundations of bridge piers, etc., are made in winter by open cuts, the rivers being frozen solid to their beds, and the earth below them, so that it can be quarried like stone. When the work reaches below the originally frozen stratum air is blown down through iron pipes, thus making a solid wall to the excavation. The excavation is enclosed and roofed over when the mason work is begun and kept above the freezing point by artificial heat. In this way foundations have been laid through strata full of water, without any drainage. The depth to which the soil thaws in summer varies from 8 ft. 9 in. to 10 ft. 6 in. Foundations at that depth are undisturbed by frost and rest, as it were, on a rock foundation.

Water for the stations is obtained with great difficulty. Of the 15 water stations on the line only one could be supplied from a stream. All the other streams on the route freeze solid to their beds. Moreover, the cold also prevents carrying water through pipes, even underground. Lakes and ponds on the line freeze to the bottom for the most part, like the rivers; moreover their water is generally too salty to use in locomotives. This has led to the resort to wells, which are dug as near to the tanks as possible. The pipes from the wells to the tanks pass through masonry on timber galleries which can be heated from the pumping engine. Provision is made for heating the wells themselves, either by stoves above the surface of the water, or by pipes discharging steam into the water. In most of the wells the water is more or less salt, and the problem of the water supply is not yet fully solved. It has even been suggested to dam a fresh water spring, and from the pond so formed quarry ice in winter and melt it for the locomotives.

All of which indicates that if Russia does not attain success with her great railroad, at least she will have deserved it.

The Engineer in War.

The two latest wars, our war with Spain and the British war in South Africa, have made apparent to the world a fact which many of us had already appreciated, that war has come to be a matter of engineering. Kipling's last story in the July number of McClure's Magazine gives some interesting hints of this fact, and also of the capacity of a narrow-minded officer to obstruct enterprise and of the power of the bureaucratic mind to resist knowledge. Kipling was writing of general types, but an interesting special case is described in *Engineering* (London) of June 29.

The intelligent reader will remember the fact that an American engineer who was in Kimberley made a heavy gun while shut up in that town, which gun was of great use in the defense. This engineer, Mr. George Labram, was from Milwaukee, and was in Kimberley as Chief Engineer to the De Beers Consolidated Mines, and was killed just before the siege was raised. Evidently, the world lost in him a man of originality and force. The guns in the garrison were seven-pounders of 2.5-in. caliber, and could not reply effectively to the enemy's 15-pounders or make any impression on his works. Mr. Labram had a notion that he could build in the shops of the De Beers Co. a heavier gun, but his first difficulty was the resistance of the military authorities to the attempt to make the gun.

On Christmas day, 1899, Mr. Rhodes, chairman of the De Beers Company, gave to Mr. Labram the order to try, and work was at once begun. There happened to be on hand a billet of hammered mild steel ordered for shafting. This was 10¼ in. diameter and 10 ft. long. There were also several bars of Low Moor iron 6 in. x 2½ in. Mr. Labram thought that he could make a gun by turning and boring out this steel billet and shrinking on iron bands. In designing and carrying out the work he was greatly helped by Mr. Edward Goffe, Chief Draughtsman of the De Beers Consolidated Mines, and by several men who had had experience in the Woolwich Arsenal and the Elswick Works.

Mr. Labram and Mr. Goffe were both quite ignorant of practical gun design. They had, however, the Encyclopedia Britannica, a military treatise on ammunition, articles on modern guns in various scientific publications and a "Text-book on Gunnery" which was possessed by an enthusiastic volunteer officer. They had, moreover, mechanical knowledge and skill, ingenuity and resolution. They had already acquired some experience in making shells in the works for the 2.5-inch guns. They proceeded scientifically, assuming a maximum pressure of 50,000 lbs. to the square inch and then designing the details of bore, breech mechanism, trunnion ring, etc.

The billet was first turned to the required outside dimensions, and was bored, first with a twist drill 1½ in. diameter, then with a twist drill 3 in. in diameter, then 3 15-16 in. Finally, the tube was rifled, the apparatus for this being designed and made in the shops. The rifling was made with an increasing twist. The rings were then shrunk on, the breech mechanism applied and the gun mounted on a carriage which meantime had been built in the shops. In twenty-four days the gun was ready for trial, namely, Jan. 19. It was taken back to the shop and a few changes made, and on Jan. 23 it was handed over to the firing party and went at once into action. While in action 255 shells were fired, most of them at ranges of from 5,000 to 6,000 yards, but a range of 8,010 yards was reached. It was fired steadily during the rest of the siege, the only trouble being at first a tendency to upset in the end of the breech-block, which, however, was easily remedied. In the early firing some of the iron rings were cracked and these were replaced.

The shells had to be made and Mr. Labram designed and made a percussion fuse, which was simple and seems

to have been effective. It is expected that the gun will be mounted as part of a monument to be erected in Kimberley in memory of those who fell in the defence, and particularly in memory of Mr. Labram.

The Railroads of North China.

On the 9th of last October Mr. C. W. Kinder, C. M. G., sent to us from Tien Tsin a photograph of a map which he had compiled, showing the Imperial Railroads of North China. We have long intended to engrave this photograph for publication, but have put the matter off from month to month, and this seems to be a most seasonable time to publish the sketch, which we do, hoping that the distinguished engineer under whose direction these railroads were built is still alive and will escape unharmed.

For convenience we have engraved the map as Mr. Kinder sent it; consequently, the north is not immediately at the top, and unless the reader is careful he is liable to be misled by that fact. Further, we have added a bit of line as completed where he noted it as building.

It will be seen that, taking Peking as the point of departure, there is a railroad line running southwesterly to Pao-Ting-Fu. This was opened quite recently, having been built by Mr. Kinder. The line is 88 miles long. The concession was handed over to the Belgians, but the line was actually built under Mr. Kinder's direction. Surveys have been carried further south and some construction work done, but not much, as we understand. It was on the line of this railroad that the first attacks by the Boxers on engineers were reported.

Proceeding easterly from Peking the distance to Tien Tsin is 80 miles and the total distance to Tang-Ku, the reader will not be misled by the fact that this same Manchurian railroad is marked on the right hand margin of the engraving as going towards St. Petersburg. It is true that it is going towards St. Petersburg, although for the time its direction is almost due north, but, of course, it swings round to the west, crossing Manchuria. All of this will be quite clear to anybody who consults a general map of China. The Manchurian road was diverted from Mukden by way of Lau-Pien, a town somewhat to the west, because of political complications, but it is undoubtedly the purpose sooner or later to pass the line directly through Mukden.

The total distance from Peking to Ying-Kow, as given by Mr. Kinder, is 462 miles. Adding this to the 88 miles south from Peking we have 550 miles. Furthermore, much farther south is the little line of about 8 miles from Shang Hai to Wu Sung, and there is a branch of 10 miles, making, say 568 miles of completed railroad in China. Mr. William Barclay Parsons, in an article in *McClure's Magazine* for July gives further information about the railroads in China.

Capacity of Freight Cars.

In the *Railroad Gazette* of July 6, page 464, was an abstract of the report by Mr. L. F. Loree on the "Most Economical Size of Freight Cars," this report having been made for the International Railroad Congress. Below is a short abstract of a report made by Mr. de Marx, Traffic Manager of the Hungarian State Railroads, on the same subject.

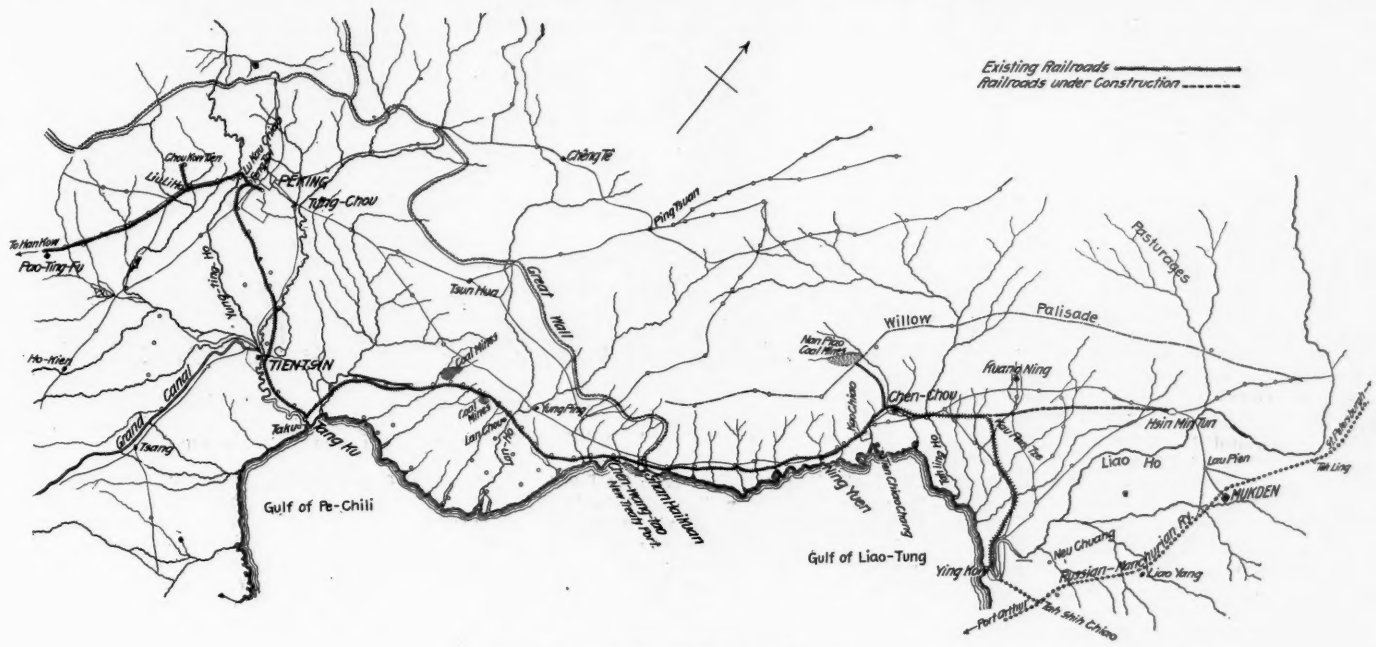
Mr. de Marx says that on the first English railroads the coal trucks were built to carry 2.65 tons, which capacity was adopted by the first French railroad from St. Etienne

Statistics of the Railroads of the United States to June 30, 1900.

The Interstate Commerce Commission has issued an abstract of the forthcoming Statistician's Report of the operations of the railroads of the country for the fiscal year that ended one year ago. For the first time since the Government Statistical Bureau was established, except in 1892 and 1893, the average annual gross earnings per mile amount to more than $7,000. In 1892 the average was 7,213 and in 1893 it was $7,190. From this abstract we copy the items shown below, with figures for the preceding two years. These last are taken from the similar statement published in the *Railroad Gazette* of July 21, 1899, in which were also given the totals for 1896.

Railroad Statistics for Year Ending June 30.

	1899.	1898.	1897.
Miles of railroad completed....	189,295	186,396	184,428
Increase in 12 months	2,899	1,968	1,652
Miles of track	252,364	247,533	243,444
Miles of road operated	187,535	184,648	183,284
Number of corporations	2,049	2,047	1,987



The Imperial Railways of North China.

NOTE.—*Approximate Scale, 1 in. = 65 miles.*

Miles From Peking.

Pao Ting Fu	88
Tientsin	80
Tangku	107
Shan Hai Kuan	254
Chen-Chou	367
Hsin Min Tun	473
Ying Kow	462

Miles of Branch Lines.

Liu Li Ho to Chou Kow Tien	10
Kao Chiao to Tien Chiao Chang (taken up)	7
Nu Err Ho to Nan Piao (not built)	30

port of Peking, is 107 miles. This line also is comparatively new, although parts of it have been built and torn up repeatedly in the years past. It was along this line that Admiral Seymour attempted to march to the relief of Peking.

Proceeding northeasterly from Tang-Ku we pass through several towns, the names of which are not significant to Americans, and at about 57 miles from Tang-Ku (as the map scales) we come to Kai Ping. This is where the Imperial Railroads of North China actually began. Mr. Kinder's first work was in building a tram line to take the coal from the Kai Ping mines down to the port of Tang-Ku, opposite Taku, on the north shore of the Pei-Ho. For years this railroad, the only one in China, was known as the Kai Ping Railway Company, Limited, and we have before us as we write an annual pass over that railroad for the year 1887, signed by Claude W. Kinder, Engineer in Chief and Superintendent.

When Mr. Kinder wrote to us last October trains were running to Chen-Chou well beyond the great wall, and 367 miles from Peking. At that time a branch was projected northwesterly from Chen-Chou to the Nan-Piao coal mines, about 30 miles, but the money for opening up the mines had not then been secured and work on the branch was still held up.

At that date track was being laid from Chen-Chou easterly and southerly to Ying-Kow, which, it will be seen, is close to the mouth of the Liao-Ho. This town is the port of the important city of New Chwang, and here it was supposed connection would be made with the Chinese Eastern Railway, which is marked on Mr. Kinder's map as the Russian Manchurian Railway. From this point of junction, it will be observed, the railroad runs south by west on its way to Port Arthur. The

to Roaane, on which road the ordinary goods trucks weighed only 1.35 tons. The earliest German railroads, however, went a little higher, making the capacity 4.5 tons. The carrying capacity of European freight cars has been gradually increased from that time, but there are still companies with trucks holding only 4.5 to 6 tons.

This reporter gets data from a large number of European railroads and none of them report a car capacity greater than 15 tons, except in the case of certain quite special cars. He quotes a passage from a German report in 1891, which seems to have been official, which favored the adoption of 15 tons as the upper limit of freight car capacity. It was thought hardly desirable to make the cars of 12.5 tons as shippers seem to want even multiples of five. On the other hand, 20 tons was too great. The load per wheel of car and lading would be seven tons—too much for secondary lines. It was thought also that bogies were too complicated, difficult of access, expensive to keep in order, and out of service a greater percentage of the time because of being out of order. Moreover, the turn-tables are too small for cars so big as that, and there were difficulties in the adaptation of brakes and drawbars for such cars. Therefore, it was recommended that 15 tons on four wheels should be the maximum for freight car trucks. These arguments sound to the American reader infantile, but they seem to have been taken seriously in Germany. Mr. de Marx does not quite agree with them, but he discovers that the railroad managements do not favor bogie trucks for freight cars, and he concludes furthermore that taking into consideration present customs and habits a 20-ton car would be too big for convenience.

Fifteen tons is now adopted as the normal standard for new rolling stock and iron underframes are in general use. These appear to be more reliable and no more expensive to keep in order. A number of familiar arguments are brought forward to support the opinion that 15-ton trucks would be advantageous, as, for instance, the reduced number of cars, the reduced number of trains, the reduced number of journals, the fact that the proportion between gross load and net load is more favorable, etc. All of these, however, are so well known to our readers that we need not repeat them. Finally, the report proposes the following resolution, which seems to be harmless, to say the least: "As advantages result from the use of trucks of considerable tonnage both to the railroads and to the public it is advisable to promote the use of such trucks as much as possible."

Number in hands of receivers.	71	94	128
Mileage in hands of receivers.	9,853	12,745	17,862
Locomotives	36,703	36,234	35,986
Cars, passenger	33,850	33,595	33,626
Cars, freight	1,295,510	1,248,826	1,221,730
Cars, total	1,375,916	1,326,174	1,297,480
Cars and eng. with p'w'r br'ks	808,074	641,262	525,286
Cars with automatic couplers.	1,137,719	909,574	678,725
Employees	928,924	874,558	823,476
Employees per 100 miles of road	495	474	449
Capital stock, com'n, millions.	$4,323.3	$4,269.3	$4,367.1
Capital stock, pref'd, millions.	1,191.7	1,119.0	997.6
Capital stock, total, millions..	5,515.0	5,388.3	5,364.7
Funded debt, millions.....	5,518.9	5,430.3	5,270.4
Current liabilities, millions ...	554.3	540.0	578.5
Tot'l stock and f'd debt, millions	11,033.9	10,818.6	10,635.0
Total stock and funded debt per mile of road	60,556.0	60,343.0	59,620.0
Dividends paid, millions	111.0	96.2	87.1
P. c. stock rec'v'g no dividend.	59.4	66.3	70.1
P. c. mtg. bonds rec'n'g no int't	7.9	11.3	13.6
Av. div. on div.-paying stock..	5.0	5.3	5.4
Gross earnings, year, passenger, millions	$291.1	$267.0	$251.1
Gross earnings, year, freight, millions	913.7	876.7	772.8
Gross earnings, year, total, inc. misc., millions	1,313.6	1,247.3	1,122.1
Average of same per mile.....	7,005.0	6,755.0	6,122.0
Operating expenses, millions ..	857.0	818.0	752.5
Net earnings, millions	456.6	429.4	369.6
Other income, millions	148.7	138.2	125.1
Net income, millions	605.3	567.6	494.7
Fixed charges, etc., millions...	441.2	427.2	413.4
Net avail. for div., millions...	164.1	140.3	81.3
Dividends paid, millions	111.1	96.2	87.4
Passengers carried, millions ...	523.2	501.1	489.4
Passengers, one mile, millions.	14,591.3	13,379.9	12,256.9
Freight carried, million tons..	959.7	879.0	741.7
Same, one mile.....	123,667.3	114,077.6	95,139.0
Avg. rate per ton mile (mills.).	7.2	7.5	8.0
Avg. pass. fare per mile (cts.).	1.92	1.97	2.09
Employees killed	2,210	1,958	1,693
Employees injured	34,923	31,761	27,667
Passengers killed	239	221	222
Passengers injured	3,442	2,945	2,795
Other persons killed.....	4,674	4,680	4,522
Other persons injured.....	6,255	6,176	6,269
Total killed	7,123	6,859	6,437
Total injured	44,620	40,882	36,731

The statistician adds to his statement a number of

paragraphs explaining some of the items. The operated mileage from the total length of railroad because some sections of road are used by two or more companies, and also because some roads, a very few, fail to promptly send their reports. Cars owned by private companies and firms are not included in the returns made to the commission. Bearing in mind this omission, attention is called to the following averages: Locomotives used per 100 miles of line, 20; cars, 734; passenger miles traveled per passenger locomotive, 1,474,765; ton-miles per freight locomotive, 5,966,193. These averages are higher than in the previous year, and the number of cars in use was smaller, relatively to the work done.

The amount paid in wages during the year was $522,967,896. This is about $77,000,000 more than in 1895, and is equal to about 60 per cent. of the total operating expenses, or 40 per cent. of the gross receipts. The number of ton-miles per mile of line was 659,565; increase, 41,755. The number of persons killed in coupling or uncoupling cars was 260, injured 6,765; same in previous year, 279 and 6,988. Compared with the total number of persons employed, one out of every 420 employees was killed, and one out of every 27 was injured; of trainmen, one out of every 155 was killed, and one out of every 11 was injured. For each passenger killed 61,051,580 passenger-miles were traveled.

Statistician Adams repeats his former recommendation that laws be passed providing for statistics from express companies, private car companies, etc.

New Passenger Station at Richmond.

The Chesapeake & Ohio and the Richmond, Petersburg & Carolina (the latter being the Richmond extension of the Seaboard Air Line) are building, at Richmond, Va., a large and imposing passenger station. The design, from plans of Wilson Bros. & Co., Architects, Philadelphia, is shown herewith.

In arranging the plan of the main or track floor the architects have followed the general plan of the well known Philadelphia & Reading Terminal Station at Philadelphia, which they designed.

The general waiting room (about 2,200 sq. ft.) is placed central and is flanked on the one side by the ladies' room, entrance stairs and elevator, and on the other side by the dining room, the exit stairs and stairs to the upper floors. This arrangement gives a spacious effect and ample room for handling crowds; and it also affords good light and ventilation. The arrangement of the main entrance and exit stairs is such that either is equally available for either purpose, a decided advantage when there is a rush all in one direction. These stairs have been very carefully studied, being a vital point in the design.

There is also a general stairway and an elevator from the ground floor to the fourth floor. These are for the occupants of the railroad offices on the third and fourth floors and also accommodate passengers going to or coming from the carriage concourse.

The main passenger elevator from the ground to the track floor, about 8 ft. x 10 ft., is located adjacent to the main entrance stairs.

The ladies' retiring room, about 18 ft. x 29 ft., is on the track floor, away from the passing crowds. The men's toilet is also on this floor.

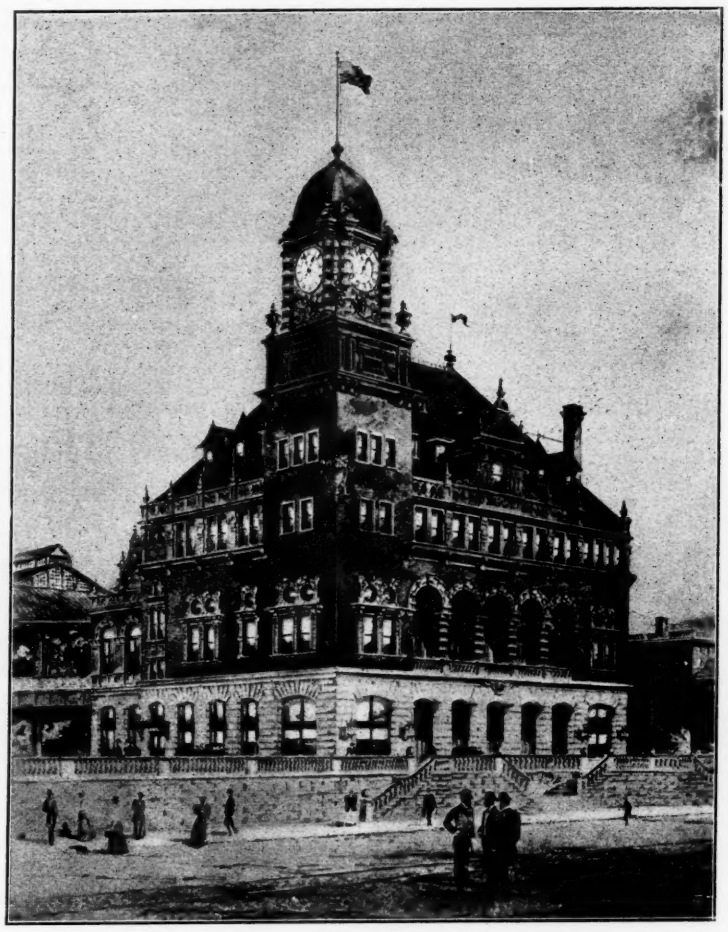
It will be noticed that the interior of the second story has been arranged with colonnades and large openings. This gives a beautiful vista into the upper parts of the dining room and the ladies' room, so that there is a continuity of architectural dignity from one end of the building to the other. The ground floor waiting room, 1,900 sq. ft., is centrally located and here are the ticket offices. The space at the left of this waiting room will be for a drug store and the other side for a barber shop and baths.

The baggage room, 34 ft. x 45 ft., and the express room, 21 ft. x 33 ft., are at the rear of the lower waiting room. They have large hydraulic lifts, 8 ft. x 12 ft., connecting with the train shed. The wagon entrance for baggage and express matter is by a driveway in the rear of these rooms.

The ground floor is elevated about 8 ft. above the street, to make sure that the station will be above the water level in case of floods. Passengers can reach the lower floor from the street by means of steps at the front, or can avoid the steps by taking the footwalk built inside of the street wall and starting at the first cross street above the station. This cross street is above the flood line. The third floor will be divided into offices suitable for the uses of the respective companies. The fourth floor will be arranged for the use of the Railroad Young Men's Christian Association with rest rooms, bath rooms and reading rooms. The kitchen for the restaurant will also be placed on this floor.

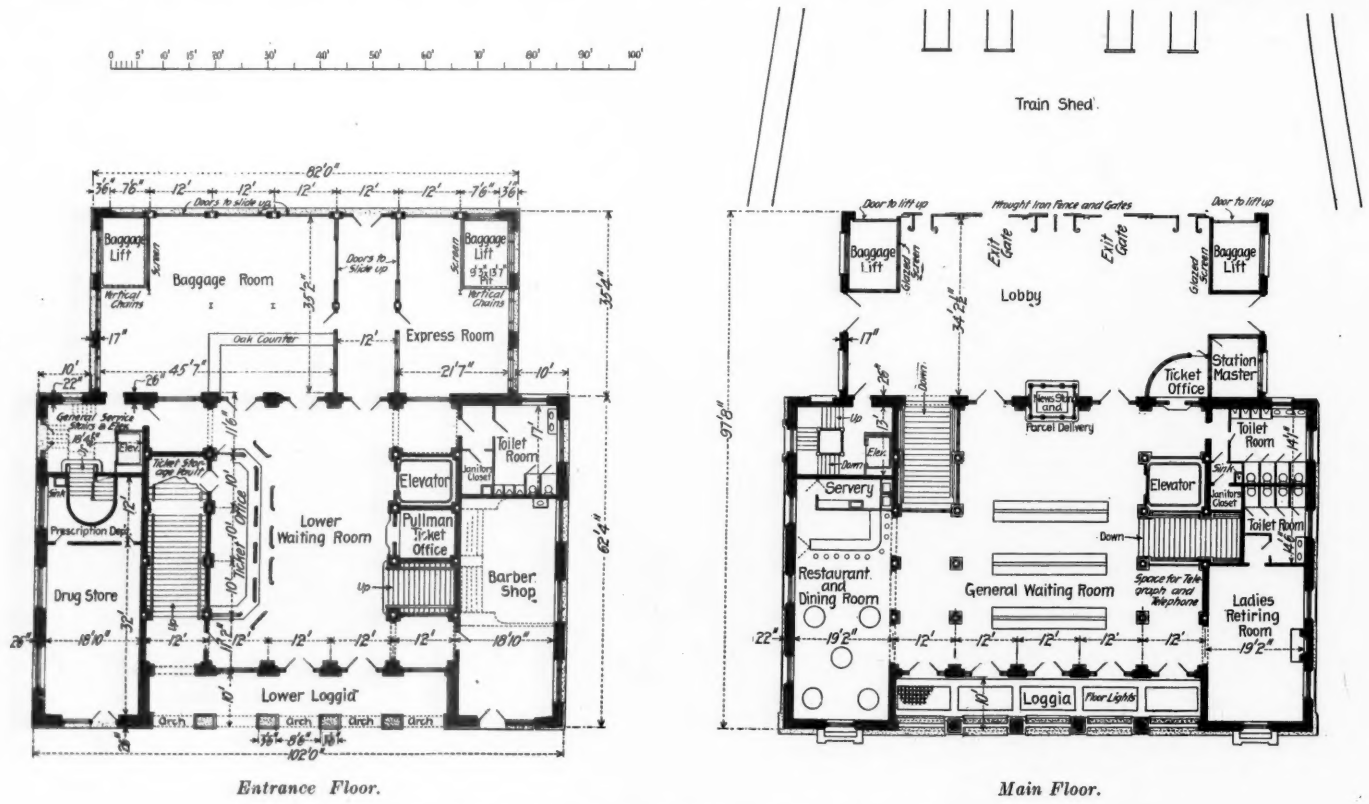
The material for the exterior of the station will be light-colored Kentucky stone up to the track floor, and above that old gold Pompeiian brick with harmonizing terra cotta trimmings. The roof will be of dark red tile. The tower shown on the corner of the building, 110 ft. high, will form a conspicuous land mark, and will have a clock with faces on all four sides. The main architectural feature of the interior will be the second story, and the column and pilaster finish and the wainscoting will be of marble, and the floors will also be of marble.

The train shed has nine tracks, and is to be open on the sides. It will be about 550 ft. long. The structural material will all be at least ⅜ in. thick. The roof will



New Union Passenger Station at Richmond, Virginia.

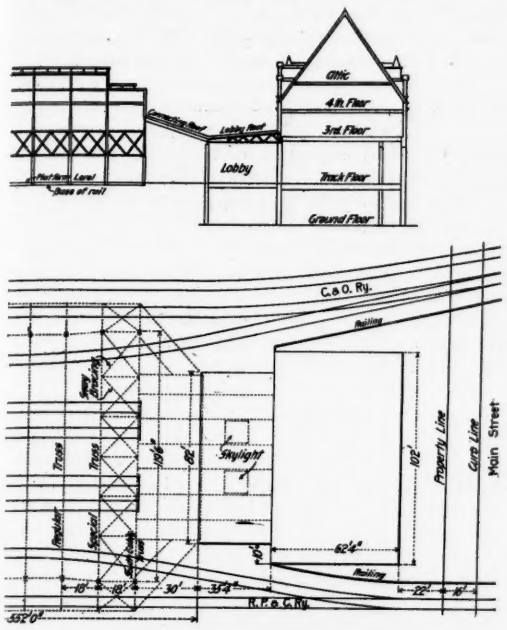
The Chesapeake & Ohio Railway and the Seaboard Air Line.



Entrance Floor. *Main Floor.*

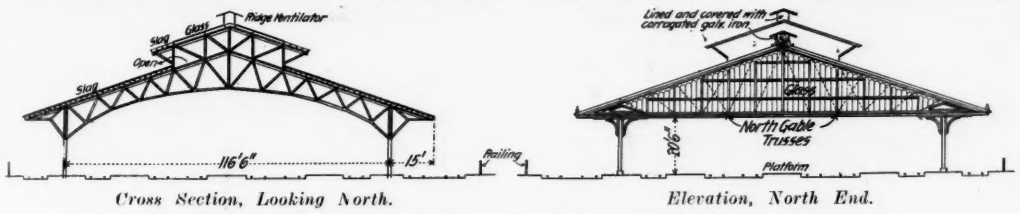
New Union Passenger Station at Richmond for the Chesapeake & Ohio and the Seaboard Air Line.

be of yellow pine purlins and sheathing covered with felt and slag roofing. Messrs. Wilson find nothing so permanent for a train shed covering as a slag roof, and it also has the advantage of being the most economical. The



Richmond Passenger Station.

skylights over the ventilator of the shed will be made of ½-in. rough plate glass, with heavy wire screens underneath. The ventilators are entirely open at the sides to insure good ventilation. It is believed that the small amount of snow or rain which may be driven in



Cross Section, Looking North. *Elevation, North End.*

Train Shed—Richmond Union Passenger Station.

during unusually heavy storms is insignificant compared with the betterment of ventilation obtained by having the sides clear of all louvres or other obstructions to the free passage of air.

This station is being built by Messrs. J. E. & A. L. Pennock, of Philadelphia.

Maintenance of Way.

Among the questions reported on for the International Railroad Congress, sixth session, to be held in Paris, is "Systems adopted for the maintenance and renewal of permanent way on lines of heavy traffic so as to avoid slackening speed of trains." For the purposes of these reports the railroad world is divided into three parts, and the May issue of the *Bulletin* of the Congress contains the report of Mr. F. Tettelin, Permanent Way Engineer of the French Northern Railroad on France, and the report of Mr. L. A. Denys, Principal Engineer, Head of Division Way and Works, Belgian State Railroads, on all countries except France, Austria-Hungary, Roumania, The Netherlands, Luxemburg, Switzerland and Germany. The other division of the report was printed in an earlier issue.

The reporters had first to agree upon a definition of lines with heavy traffic and decided to consider only such lines as have 10,000 trains or more a year, per track, some of such trains running at 60 kilometers (37.3 miles) per hour or more.

These reporters divide the method of permanent way maintenance into two broad classes, namely, "inspection" and "revision." In the inspection method places requiring repair are looked for daily and attended to in the course of current work. In the revision method each track is overhauled systematically in selected lengths and places. In general terms we may say that the method by systematic revision is general, almost universal, in fact, in France and Belgium, while the system by inspection, or a mixed system, is used practically everywhere else. In the St. Petersburg Congress (1892) Mr. Bruneel, Engineer of the Belgian State Railroads, said that all who had tried the revision method have declared it satisfactory. Those who were convinced to the contrary were engineers who had not tried it. "The old method of maintenance by inspection has been abandoned by all the French companies." This strikes us as being perfectly natural, considering the French passion for system and minute organization. To go day by day over the line, picking up detached places, would be quite foreign to the French habit of mind.

France.

The revision system was originally tried in Alsace in 1865. It was gradually extended on the Eastern Railroad system, and complete rules covering it were in existence in 1878. Some of the French railroads have for a dozen years been working under what they call hectometric revision. In this system a gang overhauls at least one-half hectometer (54.7 yards) before going elsewhere. This allows the mobility of the gang to be retained while compelling it to conform to the complete method of work necessary for the revision system. When the whole of the track has once undergone hectometric revision the gang generally works continuously forward along the line from end to end. Thus hectometric revision becomes ultimately general revision. The name which is retained is descriptive of its origin rather than of its final form.

According to the quite general practice in France, railroads laid with rails of, say, less than 88 lbs. per yard, and having, say, above 15,000 trains a year, are revised annually. Lines having rails of somewhat heavier weight, whatever their traffic, and other lines having from 7,500 to 15,000 trains a year are revised every second year. Lines of less importance are revised every third year. Careful records are kept, and the Permanent Way Engineer is able to see the progress of revision constantly. Elaborate rules and instructions are prepared telling the men how to do the work, down to minute details. Permissible limits are set for every kind of defect. The men are even instructed how to tamp ties in squads of four, shifting with precision from one side of the tie to the other. "Hence the men become thoroughly drilled like soldiers, and revision is carried out along the line with a discipline and exactness which reminds one of the operations of an army."

No deductions are to be drawn from the statements sent in by the different French companies of the number of working days required to thoroughly revise a unit of track. The answers are not comparable, but it may be said that under average conditions one man can perform the work of revision of one kilometer (0.6 mile) of main line track per year in the six or seven months during which such work is carried out. He will do 8 to 10 meters a day during the 20 days per month that he devotes to this work, the rest of his time being taken up by off days, partial repairs, maintenance of signals, roads, earthworks, etc. The Eastern Railroad reports that the men required for maintenance vary from 1.61 man per mile to 0.56 man per mile, according to the character of the line and the traffic. This includes maintenance of track and watching and maintaining sidings. The State Railroad says that on single track with wooden ties the maintenance of a mile a year requires 435 days' work, although a double track section, also on wooden ties, requires but 338 days' work. Another section of single track with metal ties requires but 290 days' work per mile. The Southern estimates 145 days per year per mile of single track. On the Northern, track labor varies from 80 days per mile per year to 322 days. The Orleans gives an average of 274 days. The P., L. & M. finds that on lines of double track and heavy traffic, maintenance takes 1.61 man per mile.

A good many scattering pieces of information can be found through the report, which it is difficult to summarize in any logical way. It appears, for example, to be quite common practice under this revision system to divert the traffic from a section of double-track working it as single track, putting in switches and temporary signal posts, but connecting up the ends of the section under revision during the night, so that night traffic may not be stopped if anything should occur to obstruct the traffic on the single track which is in use. This single track is not extended to the stations. The lines inside the station limits are renewed under special arrangement.

The Northern Railroad reports that the state of the lines is more satisfactory under the revision system. The engineer can work out a periodic scheme for maintenance work and follow the progress of the work by the records in his office. The inspection method leaves the care and determination of repairs to employees of lower grade, and it is difficult for the engineer to keep check on work and material. The men required for revision are fewer in number than those required under the inspection method. For instance, on a certain 80 miles of line, with 60.5-lb. rail, sand ballast, before 1894 the inspection method was employed, and the yearly charge was 1,895 cross ties and 60,500 francs. Since 1894 under the revision method the yearly expenditure has been 1,780 ties and 48,000 francs.

Details of the regulations for the work as carried out by various companies are given at great length, and some of these might be of interest to American readers.

Other Countries.

Mr. Denys, reporting on other countries, as mentioned in the first paragraph of this article, says that in Belgium the method is by revision. On the State Railroads of Belgium the working days per annum to keep a unit length of line in repair vary according to the locality, etc., from 240 to 480 days per mile. On the Belgian Northern the average is 241 days per mile per year.

He finds that the four railroad companies from which he gets reports from the United States, also most of the railroads of Great Britain and Ireland, maintain by the system of inspection, as it is called. The Great Eastern, however, maintains by systematic general revision and the Great Northern of Ireland uses both methods.

The time required for maintenance is, on the Illinois Central, 313 days per year per mile, on the New York, New Haven & Hartford, 250, on the Lehigh Valley 240, on the Fitchburg 225, North British 265, Midland & Caledonian from one to 1.2 man per day, Great Eastern 365 days per mile per year, Great Northern 310 days, Great Central 200 to 240, Lancashire & Yorkshire (extremely heavy traffic) 450, Great Northern of Ireland 240, Glasgow Southwestern 260, London & Southwestern 1.2 men per day. The East Indian Railway maintains by the inspection method, but employs 552.5 working days per mile per year. This, however, is out of the comparison, labor being cheap and correspondingly inefficient. In New South Wales maintenance is carried on by inspection, as also in South Australia. In New South Wales the annual work would be about 273 days a mile and in South Australia 305.

In Italy, Southern system, maintenance is by general revision, which has been found more trustworthy and easier to control than by inspection. The labor is about 0.6 man per day per mile. In Russia the general system is by inspection, and the working days per mile per year from 443 to 724. Doubtless the severe winter has a good deal to do with the heavy labor charge for maintenance. From October to April the roadbed is completely frozen, causing much heaving of the track.

In summing up his report Mr. Denys says that 23 out of 29 administrations which have answered him adhere to the old method of maintenance by inspection, three use the general revision exclusively and two a mixed system. His opinion is that the revision system is too rigid, and is not both effective and economical at the same time, unless the rules are relaxed, as practice dictates. He gives up all hope of being able to draw any sound conclusions as to the annual cost of maintaining a unit of track, because the conditions vary so greatly as to curves, grades, traffic, climate, etc. "One thing is, however, quite clear, namely, whatever the system or other conditions, the work of current maintenance is carried out on all lines of heavy traffic without compelling trains to reduce their speed."

Much detailed information is found in the reports which he received from various companies, and the discussion of these reports has some useful suggestions. These, however, it is hardly worth while to try to summarize.

Mr. Denys finds that the work of maintenance is carried out by the railroads with their own men, except the Lancashire & Yorkshire, which makes renewals exclusively by contract labor, and two administrations of the Russian State Railroads, one of which lets out the work of reballasting to a contractor and the other the delivery of the ballast.

Foreign Railroad Notes.

The opening of the Danube improvement at the Iron Gates has not been followed immediately by the hoped-for improvement of traffic. The Danube Steamboat Co., the chief carrier on that great river, had expenses greater than its earnings in 1899, when its loss was almost as great as its net earnings in 1898. In its report it complains of the tolls at the Iron Gates, though they had comparatively little effect last year, because there were so few cargoes. This was due to a failure in the harvest on the lower Danube in 1899.

On a new limited express between Berlin and Kissingen, seat tickets (as in our parlor cars) are sold not only for the first and second-class places, as has been the rule with such trains heretofore in Germany, but also for the third-class. In this class the passenger pays 12 cents for distances of 150 kilometers (93 miles) or less, and 24 cents for greater distances. In the first and second class, as heretofore, the charges are twice as great. Passengers on this train from one Bavarian station to another do not pay for seats. The distance is 263 miles, only 40 miles of which is in Bavaria.

When the Simplon Tunnel is completed, by building a loop line between a French station and a station just over the Swiss border, the route from Paris, the north of France and England to Italy would be made 11 miles shorter in actual, and 22 miles shorter in virtual length (by which distances for freight are calculated) than over the route by the St. Gotthard. The French company is said to be expecting a subsidy from Switzerland to help build this cut-off, but it is reminded that by the Simplon route the part of the London-Italy line in Switzerland will be but 127 miles, while by the St. Gotthard it is 234 miles, so the Swiss proportion of the through charges would be much the larger by the latter. Further, the Swiss Government has already taken steps to acquire the St. Gotthard line, and so far has done nothing about the Simplon line, and probably will not for some years. So to subsidize a road to divert traffic from the St. Gotthard would be to pay for the diversion of its own business to its competitors, and the Swiss are too canny for that.

Noblemen are found in pretty much all occupations in Italy, but not so often north of the Alps; so that one is struck by the fact that in a list of transfers of four "division engineers" on the Bavarian State Railroads, two are barons.

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS

CONTRIBUTIONS—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussion of subjects pertaining to ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

ADVERTISEMENTS—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

A comparatively small number of cars and locomotives were ordered during the month of June, as shown by our news columns, there being 4,024 cars of all kinds ordered and 43 locomotives. About the same number of cars were ordered as in April, which was the smallest month this year, while fewer locomotives were ordered in June than in any month this year. The car orders are divided as follows: Box and stock cars, 2,690; coal and ore cars, 1,231; flat cars, 65; tank cars, 20, and passenger cars, 18. Of the locomotives, 17 were for freight service and 26 for export.

On another page is a short abstract of a report on ballast made by Mr. Feldpauche, Principal Assistant Engineer of the Pennsylvania Railroad, to the International Railroad Congress. Obviously, a good deal that he says must be quite familiar to the American reader, and much of that part we have omitted; but there is a great deal in the report which is of interest to us in the United States, and all of it will be of particular interest to European engineers. It tells them in a definite and circumstantial way much that they can never have known before about American practice in ballasting, and particularly in the use of machinery. To us, however, the most interesting part of the report is the discussion of the best size of broken stone ballast. Four different sizes are considered, namely, screenings, ¾-in. stone, 1½-in. stone, and the standard or 2½-in. stone. All of these sizes have been tried more or less on the Pennsylvania, and Mr. Feldpauche gives a summing up of the opinions collected so far. This will be found at considerable length in the article to which we refer. We judge from a careful reading of his report that it is Mr. Feldpauche's opinion that either the ¾-in. or the 1½-in. ballast will turn out to be the best. As between these we do not discover his preference. The Pennsylvania is now making careful observations of the performance of the three sizes (not including screenings) on the line between Baltimore and Washington, and we shall shortly have some definite information from the observations there. Meantime, it seems reasonable at least to say that the standard 2½-in. size is much too big for the best results.

The Piston Valve.

In another column is a general description of a new class of engines recently added to the equipment of the State Railroad of France. Its chief interest to the American reader is in the completeness with which it presents the design of a piston valve that has given good service in France, and yet it is hardly likely that the French valve, with its complicated construction, will be looked upon with favor by the American designer, notwithstanding the reassuring statements concerning its satisfactory behavior.

A matter which perhaps more justly merits his attention is to be found in the port-areas of the French engine, for in America, port-areas and valve-travels have sometimes been carried too far for best results. In the engine described, the area of the steam ports for cylinders, approximately 17 in. x 26 in., is but 15 inches, and the openings in the valve casing extend but half around its circumference. This contrasts strongly with the American practice of utilizing the entire circumference. But while the port-area is small, the ports themselves are short and straight.

The normal clearance in American slide-valve engines varies from 8 to 10 per cent. of the volume displaced by the piston, and it has usually happened that the adoption of the piston-valve has operated to increase this value. It is, therefore, of interest to note that the port arrangement of the engine under discussion made the clearance about 3 per cent. of the cylinder volume. This amount was so small that the engine could not be worked at short cut-offs until the space at the ends of the cylinders had been increased by the substitution of a piston having recessed faces for one having plain faces, and by setting out the heads.

In the comparisons between two classes of simple engines, one having flat valves, and the other piston valves, the claim of a gain of 10 per cent. in tractive power, through the adoption of piston valves, seems to suggest indifferent valve construction in the older type, while an improvement of from 2 to 3 per cent. in fuel consumption is quite within the limits of reasonable expectation.

In comparing the performance of the piston-valve engines with that of the compounds, M. Desdouits shows the simple engines to be equal to the compound engines when employed in similar service. How far such a conclusion is justified, the reader cannot, of course, fully determine. The explanation is not to be found in poor performance of the compounds, since it is plainly stated that both simple and compound engines required only 21 pounds of water per horse power per hour, and that the consumption of the simple engine, when favored by a high speed of rotation, came down to 20 pounds. As American engineers have been taught by long experience to look upon 25 pounds of water as minimum for a single-expansion locomotive, and as they are well satisfied with a compound, even when its consumption remains above 20 pounds, they will be inclined to look with some doubt upon the figures and arguments presented, as well as upon the conclusion that a simple engine with piston-valves may be taken as the full equivalent of a compound engine.

It should be noted, also, that M. Desdouits' conclusion in this particular is not sustained by the prevailing opinion in France, where three of the most important systems, the Eastern, the Northern, and the Paris, Lyons & Mediterranean, are fully committed to the policy of making large use of the compound type in their new equipment.

Two Ways of Reducing Freight Rates.

There are various ways of accomplishing most objects, and getting freight rates reduced is no exception to this rule. A press despatch of recent date says that the state railroad commissioners of Mississippi have invited the railroad commissioners of other Southern states to join in a conference to be held next autumn, to consider alleged inequalities between the freight rates in Southern states and those (made in the Southern states) to or from the Northern and Western states. It is alleged that these latter are so much lower than local rates that there is serious discrimination against cotton mills in the South. Another press despatch says that the Merchants' Association of New York, which is making a strong appeal to the railroads in behalf of New York wholesalers, who claim to be aggrieved by recent advances in freight rates, has sent a representative to Chicago to argue before the Southern Classification Committee at its meeting in that city.

This representative, Mr. J. M. Langley, made an elaborate analysis of the changes in classification by which freight rates from New York to the South have lately been advanced, and told the committee, in substance, that the merchants would keep up their agitation until they won their case; and as persistency generally makes the railroads weaken, in matters of this kind, we may fairly assume that the Merchants' Association will finally get a good degree of satisfaction. It has unlimited courage, the result of past successes.

These two methods of going about these undertakings afford contrasts which illustrate some of the difficulties of rate regulation which are matters of common experience, but which it is not always easy to see through. The state commissioners adopt the slow, decorous, and legal method. They will hear all sides and then decide. Their action, if any is taken, may not have effect for a year. But the merchants take the shortest cut, regular or irregular, and present their grievance directly to the active rate-makers. What they do they do quickly. The commissioners, though they may be strongly partisan, and perhaps ready to reduce all rates to the basis of carload rates on sand, if some alleged economist asserts that "postal rates" are beneficial to the people, will pursue a form of logical argument, and will present reasons purporting to justify whatever they may do. The merchants, on the other hand, present whatever considerations they may deem useful to their purpose, logical or illogical.

One argument presented at Chicago was that the railroads of the South were earning 20 per cent. more than a year ago. The facts that expenses had also increased, so that net earnings might finally prove to be smaller than at first appeared, and that the sellers and buyers of the goods are probably increasing their incomes much faster than the railroads are, were apparently not touched upon. The commissioners will probably consider all real grievances, which seem to be of some magnitude; they will recognize that a score of officials, state and railroad, cannot afford to hold long conferences over matters which are comparatively too small to justify the expenditure of time. The merchants, however, enlarge on every grievance they can find, and may carry their point by sheer persistency and massing of small complaints. Among the articles mentioned by the Chicago speaker as suffering from high freight rates were base-ball bats, honey, pumice stone, shot and yeast. The real burden on the consumer (or on the legitimate jobber) from increased freight charges on these articles probably could not be measured in dollars (or even in cents) without taking the aggregate business for a long time, but the complaint helps to swell the aggregate.

We do not draw these contrasts for the purpose of passing judgment on either one of the two plans, but merely to show one of the differences which may be found to exist between bureaucratic methods and the methods of the American hustler. The merits or desirability of the respective plans will be sufficiently apparent to the reader without any explanation on our part.

But aside from methods, both these complainants employ what, from a broad view, is a fallacious argument. They want the Southern roads to carry at the same rates as Northern and Western roads which do a much larger business. The commissioners want cotton carried 100 miles or 500 miles in the South at the same rate per mile as on a haul of 1,000 or 1,500 miles to a Northern city. The New York merchants want groceries or dry goods carried 1,000 miles south as cheaply as 1,000 miles west. If a railroad officer says that the long haul, or the westbound haul, costs less, they reply that the Government ought to manage the railroads and compel uniform rates. But if the railroad assertion is true (and it has not been denied), why should the Government violate an economic principle for the sake of favoring a part of the people? Should not plain business principles and economic laws be the guide for a Government railroad manager as well as for any other?

Certain inevitable conditions tend to produce inequality in freight rates, in different territories or on different lines, regardless of whether the railroads are owned by the state or not; of whether railroad traffic officers are wise or unwise, honest or dishonest; and the fact ought to be frankly recognized by everybody. Railroads carry cotton to Massachusetts at low rates, not because they like small profits, but because steamers will supply those mills if the railroads do not. Rates on carpets or pickles from New York to Atlanta may be higher than to Chicago, but still they may be low as compared with the charges on freight from Augusta to Atlanta, because the New York shipment is competed for by a carrier who uses steamboats part of the way; and the Augusta rate may be the more nearly just, from an abstract standpoint. The rate to Chicago is kept very low because the railroads are compelled to haul empty cars to that city every day in the year; how can a state justly compel similar rates where cars must be sent specially to carry the goods?

These are all trite truths, but it seems desirable to restate them occasionally, lest the impression become general that importunity, kept up long enough, can always succeed in getting rates reduced. As long as most of the railroads have surplus facilities a good part of the time, probably it will succeed very often, but don't let us deceive ourselves with the idea that the success is legitimate.

To the railroad manager who reads this article and who turns from the last paragraph back to the title, probably the first suggestion will be that though there

are two or more ways of reducing rates, there is great doubt whether there is any way at all of advancing them. With combinations of shippers, like the Merchants' Association, in all the large cities, always ready to object to any advance, and using, in their pleas, numerous arguments which the railroads themselves have perhaps approved (and even taught) during the recent years of hard times, any attempt to advance rates is uphill work. In this present case, as in the similar attempt of the Trunk Lines, the work of stiffening the classification has been a good deal like building a roadbed in some swampy districts, where the destructive influences of water, acting 24 hours a day, will baffle the best efforts of the builders, working 12 or 16 hours a day. The merchants who aim to tear down freight tariffs never sleep.

Under the caption, "The Failure of a Great Experiment," *The Engineer* (London) expresses its opinion of water-tube boilers and high initial steam pressures as latterly used in the British war ships. The Belleville boiler, and engines suitable for using steam pressures as great as 250 lbs. per square inch, have been freely substituted for the Scotch boiler and its lower pressures within the last five years. The chief difficulties of this innovation are said to have been found in inability to reduce pressures to suit fractional parts of the total ship's power, for example, in cruising at half power; in failure to keep the boilers and engine fittings steam tight, and in the consequent enormous consumption of fuel from these combined causes. The statement is unreservedly made that the Belleville boiler must be worked at high pressure; that the engines fitted to receive this high pressure are the "real, if involuntary culprits," and that the double experiment is a failure, the full extent and gravity of which are not yet known. The failure of one great firm of manufacturers is attributed to a protracted attempt to produce Belleville tubes of "superlative, and all but unattainable qualities," required by the Admiralty. Without such tubes the Admiralty dare not send ships to sea. *The Naval and Military Record* is quoted as saying that the cruiser Europa was eighty-eight days from Portsmouth to Sydney. Of this time, fifty-eight days were used in steaming and thirty days coaling. The average coal consumption for the trip is placed at 5 lbs. of coal per indicated horse power hour, at 12 knots per hour—2.1 knots per ton of coal. At current prices for the eight coaling points at which it was necessary to stop, the coal bill is estimated at more than $95,000. The Europa is said to be no exception in inefficiency, as the Hermes and the Highflyer are flatly called "utter failures." This is a definite assertion of world-wide interest. In view of the tremendous importance that naval celerity has recently assumed, and the great revival that has come to the United States as a sea-faring nation, it is well to refer to opinions expressed upon points at issue, by Admiral George W. Melville, Chief Engineer, U. S. Navy. At the seventh general meeting of the Society of Naval Architects and Marine Engineers, Nov. 16 and 17, 1899, Admiral Melville, in a paper, referred to the "general adoption of water-tube boilers for all new vessels of our navy," as a step in advance, but said that they were bad in principle and that "with some misgivings" he considered them "tactical necessities for war ships." The full text of this paper will be found in the *Railroad Gazette*, Nov. 24, 1899, p. 806. The advantages and disadvantages of water-tube boilers, compared with cylindrical boilers, were there stated by the Admiral, as follows:

"*Advantages.*—Less weight of water, quicker steamers, quicker response to change in amount of steam required, greater freedom of expansion, higher cruising speed, more perfect circulation, adaptability to high pressures, smaller steam pipes and fittings, greater ease of repair, greater ease of installation, greater elasticity of design, less danger from explosion.

"*Disadvantages.*—Greater danger from failure of tubes, better feed arrangements necessary, greater skill required in management, units too small, greater grate surface and heating surface required, less reserve in form of water in boiler, large number of parts, tubes difficult of access, large number of joints, more danger of priming.

"A saving in space has been claimed for water-tube boilers, but I do not find this claim sound when account is taken of the increase in grate and heating surface necessary in water-tube boilers to ensure satisfactory working, and because of small units the space for accessibility is increased rather than diminished. The fact that water-tube boilers raise steam quickly is of the greatest advantage."

"Car service charges are to be enforced in Omaha beginning next week. They will compel shippers to unload cars within 48 hours or pay for detentions."

The foregoing item from a Western paper calls to mind the fact that it was in 1888 that we had the pleasure of chronicling the fact that the railroads centering in Omaha had accomplished a great reform by enforcing demurrage charges. Omaha is not the only city in which there have been defections from the faith, in the dozen years since 1888, so this paragraph is not meant for a reproach, but we merely note the fact that not all railroad reforms "stick." Per diem rates for interchanged cars have fared still worse, this reform having scarcely got started, though it was proposed long before 1888. The use of gates on passenger cars and of other devices and expedients for checking dishonesty of passengers and conductors, afford another example of a halting reform. But then, perfect justice is lacking in many other branches of railroad business. Sometimes the only thing to do with an evil is to study it and watch it. And perhaps there are cases where the only thing we can do with our ideals is to aim at them.

NEW PUBLICATIONS.

Examination Questions for Locomotive Engineers.—The Union Pacific has issued a small book of questions to serve as a guide in the examination of firemen previous to promotion. The object in compiling these questions was to cover as concisely as possible most of the important points on which enginemen should be well posted and at the same time to confine the questions to practical rather than theoretical topics. No great claim for originality is made as the air-brake and signal instructions of the M. C. B. and M. M. Associations have been used complete, and use has also been made of the examination questions compiled by the Traveling Engineers' Association in 1894. However, these have been materially modified to suit the particular needs of the Union Pacific. It is the intention to distribute these books among the older firemen, who are liable to be promoted to engineers during the coming year, so that they may have sufficient time to prepare for examinations. Other roads who may care to issue examination questions will doubtless be aided by the Union Pacific book.

The Deep Waterways Report.

The report of the Deep Waterways Commission, consisting of Lieut. Col. Charles W. Raymond, Corps of Engineers, U. S. A.; Alfred Noble and George Y. Wisner has been made public. This board was appointed in 1897 to investigate and report on available routes for deep water communication between the Great Lakes and the Atlantic seaboard. Some of the conclusions are as follows:

"It appears from the investigations of the board that the most favorable route for a 30-ft. waterway from the lakes to the sea is from Lake Erie to Lake Ontario via La Salle and Lewiston, and from Lake Ontario to the Hudson River via Oswego and the Mohawk Valley, and that the same route is practically as favorable as any for the 21-ft. waterway. This route is entirely in our own country, and has a longer season of navigation than the more northerly line. The problem of its defense is much simpler than it would be were a part of it in a foreign country, and it is available as a line of communication for ships of war. In the comparison of the 21-ft. and 30-ft. waterways this route will alone be considered.

"The maximum annual traffic capacity of the 21-ft. waterway when the single lift locks are duplicated is estimated at 36,608,000 net tons, and that of the 30-ft. waterways at 35,180,000 net tons, the traffic on the smaller waterway being greater than that on the larger, owing to the difference in time expended in lockage. It should, however, be remarked that with the smaller locks, properly proportioned for the most economical type of carrier the traffic capacity of the larger waterway would be somewhat increased. The average speed on the 21-ft. waterway is 10.67 miles per hour. On the 30-ft. waterway it is 10 miles per hour.

"In the 30-foot waterway navigation would be freer and for smaller vessels a little more rapid than in the 21-ft. waterway, and there would be less danger of delay from accidents and crowding. The time required for vessel No. 1 to make a single trip from Duluth to New York on the 30-ft. waterway is six days and three hours, while the same journey on the 21-ft. waterway would require two hours longer (vessel No. 1 is of 19 ft. draught).

"In the very improbable event of a war with Great Britain every large ship of war possessed by this country would be required on the high sea. Such vessels would be unncessary on the lakes, since the greatest depth of the Canadian is only 14 ft. For purposes of naval defense the 21-ft. waterway appears to offer ample facilities.

"The 30-ft. waterway would enable the shipbuilders of the lakes to construct seagoing vessels of the largest size, both for commercial and naval purposes. With the 21-ft. waterway this industry must be restricted to the construction of vessels of not too great dimensions to pass the locks. If the width of the locks were made greater than is necessary for the carrying trade ships of larger size would be flated from the lake shipyards to the seaboard when light. This would increase the cost of the canal and diminish its traffic capacity.

"As a result of this investigation it appears that the 21-ft. waterway promises a much greater return of value relative to its cost than the 30-ft. waterway. The main advantages of the 30-ft. waterway are that it would furnish the lowest cost of transport proper to foreign markets and permit the construction of the largest seagoing vessels on the lakes."

Following is the summary of estimates of cost, the difference between the high and low level plans being the difference from the summit level between Oneida Lake and the Mohawk River:

Duluth to Tidewater, Oswego-Mohawk (High-Level Plan)

	30-Foot Channel.	21-Foot Channel.
Lake Superior to Lake Erie	$33,539,869	$46,961,818
Lake Erie to Lake Ontario	73,435,350	42,393,203
Lake Ontario to tide-water	206,253,553	155,324,968
Totals	$313,228,772	$204,679,989

Oswego-Mohawk (Low-Level Plan).

Lake Superior to Lake Erie	$33,539,869	$46,961,818
Lake Erie to Lake Ontario	73,435,350	42,393,203
Lake Ontario to tide-water	210,309,129	157,003,082
Totals	$317,284,348	$206,358,103

St. Lawrence-Champlain (With Movable Dams.)

Lake Superior to Lake Erie	$33,539,869	$46,961,818
Lake Erie to Lake Ontario	73,435,350	42,393,203
Lake Ontario to tide-water	213,123,864	141,027,415
Totals	$320,099,083	$190,382,436

The Central London Railroad.

In the *Railroad Gazette* of May 25th, page 342, and June 8, page 375, the London underground electric railroads were described. In the first-named issue a map was shown in which the Central London Railroad appeared, in its relation to other parts of the city system as a whole. The Central London Railroad is now in operation. *Engineering* (London), of June 29, contains an article treating of the opening ceremonies, equipment and cost of various factors in construction and maintenance.

It is stated that upon the 5¾ miles of this railroad there has been spent £3,114,000, or that this was the amount named in the contract. At 4 per cent. the amount to be paid annually on this investment would be considerably more than £124,000. Four years have been spent on the construction. The completion has been a matter of more than usual interest since this is one of the experimental lines, the results of whose operation will shortly determine the further progress of electrical installation in the great system of underground railroads. The financial aspect is, of course, the ruling factor, and thus far doubts have existed as to whether this could be made a paying investment. The experience of the City & South London Railway has cast doubt upon its ability to earn satisfactory dividends.

It is said that, as engineers, Englishmen must view the completion of the new line with mixed feelings; this because, while they have reason to congratulate themselves that London has always led the way in building deep tunnel lines, in the final installation they find mortification in the fact that practically the whole of the mechanical and electrical appliances comprised in the equipment of the line are of American design and construction. The engines, generators, converters, locomotives and the lifts, or elevators, were all made in America. At the time the contracts were made, much of the apparatus was larger than had been attempted, and could only be safely undertaken by engineers or electricians who had a fund of experience to draw upon and confidence in their own ability; that such experience did not exist in England. When this railroad work was undertaken, those who were responsible for it felt that their only prudent course was to place their orders for equipment in the United States.

Every station is placed on a summit, and hence the outgoing train is aided by gravity and the incoming train is retarded. The usual questions of acceleration and retardation are, of course, as prominent here as elsewhere where stations are placed at relatively short intervals, as, for example, on American elevated railroads. As arranged in this instance, a train when approaching a station runs up a gradient of 1.66 per cent., and immediately after leaving the station it descends a grade of 3.3 per cent. In running into a station, energy equal to 100 h. p. minutes is stored in the train ready to be expended on the down grade.

On Wednesday, June 27, the road was formally opened by the Prince of Wales. It was then expected that in a few days the road would be opened for general passenger traffic. The Central London Railroad, as stated in our previous publications of matter pertaining to the London system entire, runs from Shepherd's Bush to the Bank of England. The track for the whole distance is in tunnels at depths varying from 60 to 90 ft. For the greater part of the distance the tunnels are side by side, but near the general post office, where the road is narrow, one tunnel is above the other. Each tunnel is 11 ft. 6 in. in diameter, and is lined with a cast-iron tube.

There are 13 stations on the line, and it is intended to cover the distance from terminal to terminal at an average speed of 14 miles an hour with a maximum speed of 25 miles an hour. Each train will consist of seven carriages having capacity for 336 passengers, the total weight of the train when loaded being 105 tons without the locomotive. During the busy hours there will be an interval of 2½ minutes between the trains, 28 locomotives having been provided to take care of the traffic.

The locomotives have two four-wheeled trucks, and weigh 97,000 lbs. There is a motor of 117 h. p. upon each of the four axles, the armatures being built on tubes which are pressed on to the axle. The length of the locomotive is 26 ft. 7 in., the length over buffers being 30 ft., and the width 7 ft. 8 in. The cars are built with end doors, have central aisles, and the seats are arranged both lengthwise and crosswise. The central power plant is at Shepherd's Bush, the current being distributed through three converting and distributing stations. The boiler house is 148 ft. long x 87 ft. wide, and contains 16 Babcock & Wilcox boilers, each having 3,580 sq. ft. of heating surface. The boiler plant is fitted with Archbutt-Deeley water softeners, feedwater filters and Green economizers. Coal and ashes are both handled by a hoisting and conveying plant. Draft is afforded by two chimneys 250 ft. high and 10 ft. in

diameter inside. The engine room is 200 ft. long x 86 ft. wide, and contains six cross compound Corliss engines constructed by the E. P. Allis Co., of Milwaukee, Wis., U. S. A. The engines have cylinders 24 in. and 46 in. in diameter x 48-in. stroke, and run at 94 revolutions per minute. They are built to give 1,300 i. h. p., each, and stand overloading up to 1,900 h. p. An emergency governor used in addition to the governor controlling the Reynolds-Corliss gear shuts the steam off completely when the speed reaches 105 revolutions. The steam passes through a separator before delivery to the engine, and after use in the high pressure cylinder it is drained and superheated before delivery to the low pressure. Four Barnard-Wheeler cooling towers are used in connection with the exhaust condenser. Fans are driven by Belliss engines.

On the crank shaft of each engine is a three-phase alternating-current generator. The shaft is 22 in. in diameter in the wheel fit and 20 in. in the journals, which are 36 in. long. The fly-wheel is 18 ft. in diameter, and weighs 100,000 lbs. The armature is stationary, and surrounds a revolving field weighing 34,000 lbs., the complete armature weighing 48,000 lbs. Each generator has an output of 850 kilowatts at 5,000 volts and 25 periods per second. There are four six-pole exciters to energize the fields of the main generators. Each exciter is of 50 kilowatts and 125 volts, and is driven direct at 450 revolutions by a compound tandem Allis engine with cylinders 9½ in. and 15 in. diameter with a stroke of 6 in. From the switchboard there are four outgoing mains to carry the 5,000 volts pressure, the sub-stations being situated at Notting-Hill Gate, Marble Arch and the Post Office. These mains were constructed by the National Conduit & Cable Co. Altogether there are 19 miles of cable, weighing 78.4 tons. At each of the sub-stations the current is transformed to 330 volts, and is converted to 500 volts for delivery to the third or contact rail. For this purpose there are provided seven transformers, two rotary converters, switchboards and blowers. Each transformer has a capacity of 300 kilowatts at a pressure of 330 volts on the secondary side, and the transformers are coupled up on the delta system on both the primary and secondary sides. They are ventilated by blowers made by the Buffalo Forge Co. The current is taken by the locomotive, through two cast-iron shoes. It passes through an automatic circuit breaker and switch to a controller, and thence through the motors to the track rails. The rails are of 100-lb. section, and are double bonded with Crown bonds having a total cross section of .62 sq. in. The motors on the locomotive are of the series-wound, four-pole, iron-clad type.

The engineers of the line are Sir Benjamin Baker and Mr. Basil Mott. The contractors are the Electric Traction Co. The British Thomson-Houston Co., as subcontractors, work under the advice of Mr. H. F. Parshall.

Crystallization of Metals.*

BY EDWARD B. GILMOUR.

It is almost impossible to overrate the importance of this subject with reference to the designing of castings, as no one can design a casting intelligently without a knowledge of the laws which are brought into play in the cooling of a casting. There are few subjects in the foundry business that have attracted so little attention and had so little written upon them, and the best information that we are possessed of has been got by bitter experience through castings becoming defective on account of bad designs.

* Read at Chicago meeting of the American Foundrymen's Association.

I will endeavor in this brief article to give some incidents which have come under my notice. Before doing so it is necessary to refer to some of the laws which govern crystallization. What is understood by that term, in a general sense, is every operation, or process, whereby any body is made to pass from a liquid or gaseous state to a solid, and assume a definable and regular form (that is, in the grain). Crystallization is an accessory to slow separation. In metals this takes place in the process of cooling. All metals which are cast, when they change from a molten state into a solid have crystals or molecules which rearrange themselves in a regular order, according to influences brought to bear upon them. The formation of these crystals depends on the constituent particles, and can only take place if the molecules possess perfect freedom of motion. Generally, when a body passes from a liquid or gaseous state to a solid the crystals will take a definite shape resembling an octahedron, which is two four-sided pyramids united base to base. When the crystals are united in regular order all through the casting, without any weak planes, caused by the separation of the crystals, and which only occur on account of defective designs, a casting is at its strongest. Faulty designs have been a source of great trouble to the founder, and in a great many instances he is blamed for putting inferior iron into the castings. A regular formula has been used by the designer, who calculated that iron of such dimensions was strong enough to carry the load required. The practical foundrymen, more especially the steel founders, are watching the designs of castings and making the necessary changes needed to produce strong and good castings. Prof. Mallet says of the formation of crystals:

"It is a law of molecular aggregation of crystalline solids that when their particles consolidate under the influence of heat in motion, their crystals arrange and group themselves with their principal axis in lines perpendicular to the cooling or heating surface of the solid—that is, in the direction of the heat wave in motion, which is the direction of least pressure with the mass. This is true whether in the case of heat passing from a previously fused solid in the act of cooling and crystallizing on consolidation, or of a solid not having a crystalline structure, but capable of assuming one upon its temperature being sufficiently raised by heat applied to its external surface, and so passing into it."

Cast iron is a crystalline material which in consolidating obeys the laws pretty perfectly, the lines of crystallization running perpendicular to the external surface or in the direction of the heat wave passing from the body in cooling, so that if there is not even thickness in construction the crystals will run toward the point of cooling first, and heavy parts, being longer in cooling, will be subjected to a very heavy strain, which will cause a weak plane diagonally right in the center of the heaviest part of the metal. Take, for instance, Fig. 1, which is a cross section of a slide valve cylinder, right through the center of the exhaust; the point marked *a a* is the usual system in making the casting, with regular even fillets on the core and evenly rounded on the outside. The design looks all that could be desired at first sight, but in practice and theory it is unquestionably wrong, as the heavy body of metal at this place is longer in cooling than at each side, and the crystals are formed in opposite direction to each other, causing a weak plane where the ordinary observer would expect it to be strongest, when in reality it is the weakest part of the cylinder. With a number of castings of this design we had a troublesome experience. After the engines had been delivered and were running, in a great many instances the cylinders cracked at the point shown, and the first one that gave way caused a legal controversy on account of the quality of the metal; but with the repeated occurrences of these breakages the builders' attention was drawn to the construction, the result being a change in design to Fig. 2 *b b*—which is in accordance to the laws of crystallization—and resulted in neutralizing all the hard epithets which are usually showered upon each other under such circumstances. The difference in design and the change in the order of crystallization is readily seen in this illustration.

Fig. 3 shows an arrangement of crystals which causes a weak plane to run into the heavy part. Fig. 4 is an example of crystal arrangement which is very definite, and is of the strongest nature. Fig. 5 is a flat plate section with crystals following a regular order radiating from the inside, with the exception of a diagonal weak plane—which usually causes the outer edges to rise up and make a twisted plate. In order to obviate this trouble it has been found expedient to cover the whole surface of the casting with about 3 or 4 in. of sand, afterward take a rammer and strip the sand upon the diagonal lines, which will cause the casting to cool quicker at this point and change the crystals into a regular form throughout the casting. In no case should flat plates ever be cast with hard iron, for the reason that in hard iron the crystals are more pronounced than in soft iron. Fig. 6 is a round bar which shows the crystals all radiating from the center in regular order. Fig. 7 shows an arrangement of crystals in a set of building plates, which were made to strengthen the building of cylinder molds. We had a number of these castings to make, and our intention was to use the same plates for each mold, but they always split diagonally at the corner after the cylinder was cast. I therefore made a change in construction, which completely rearranged the cyrstals, as is demonstrated in Fig. 8, and gave the desired result of saving them every time. It will be apparent from the illustrations that any one having charge in the designing of castings should give particular attention to such points as are set forth, and avoid all unequal thicknesses or sharp corners. Many castings may be made which will not show any particular defects in a marked degree, because if they are exposed to great heat the crystals will rearrange themselves, as has already been demonstrated, from the entering and returning of the heat waves, and the greater the heat the more easily will the above laws be obeyed. Consequently, if the designer is familiar therewith, the founder will be saved much money and time—also a great deal of anxiety and trouble. The molder before pouring his work should be cautioned to look after his iron and see that it is of the required temperature to suit the work; for the heavier the piece is the cooler should it be poured, as the development of crystals depends upon the regularity of the cooling of the casting, and dull iron always makes stronger castings because the crystals are better defined. However, this does not always make clean castings—so that after all the molder has got to use discretion in order to produce the best results.

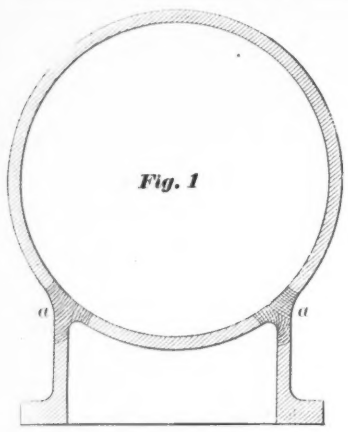


Fig. 1

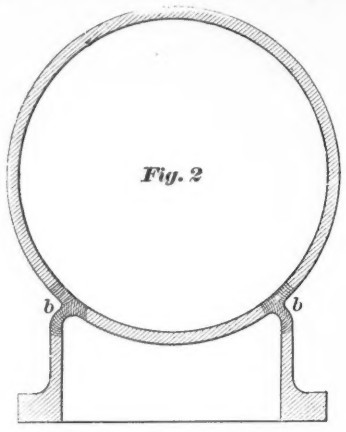


Fig. 2

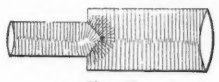


Fig. 3

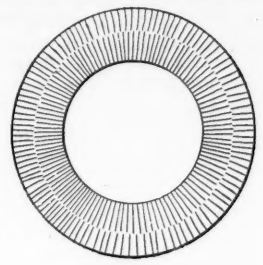


Fig. 4

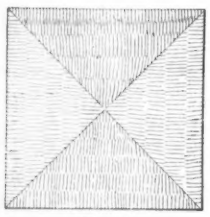


Fig. 5

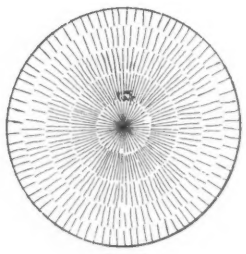


Fig. 6

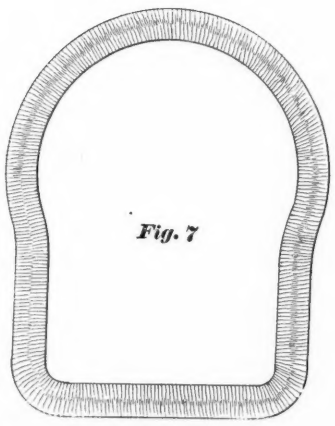


Fig. 7

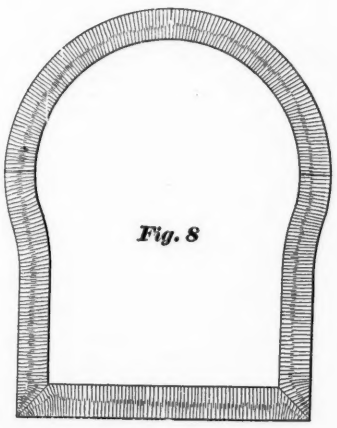


Fig. 8

Illustrations of Methods and Results in Molding and Casting.

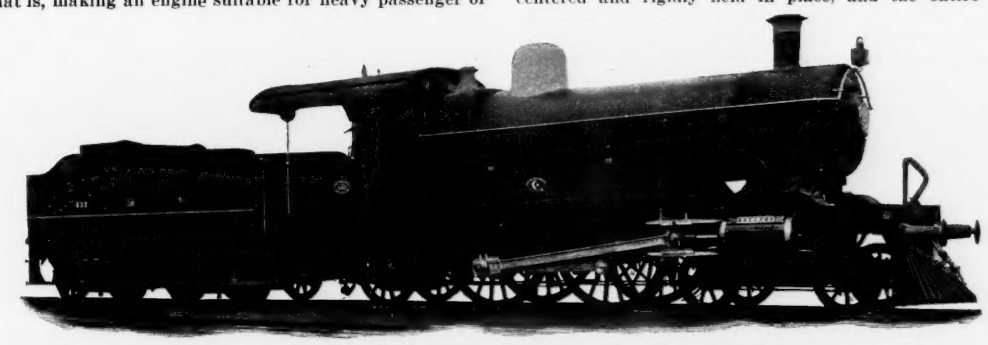
English Railroad Telegraph Code.

A number of prominent English railroads have lately adopted a new code of words to be used in telegrams on railroad business. We understand that this code has been compiled under the direction of a Clearing-House committee, and it appears that most of the principal roads are using it; though the London & Northwestern and the Caledonian appear in a list of roads which do *not* use the new code, preferring to use their own codes, which have been in force for a considerable time. We have before us a copy of the book issued by the Midland, which contains about 100 pages. The num-

ber of code words is 603. The phrases are so arranged that the code word is always the first word in a telegram; and even where there are two or three code words they are all entered before writing the other words necessary. Perhaps the most noticeable feature of the code, to an American, is the curious taste manifested in the selection of words. To the American telegraph operator, familiar with only the Morse alphabet, this list has the appearance, in some parts, of having been prepared by a crazy man. Some of the brightest gems are: Broccoli, centric, cheetah, cockatoo, cygnet, Irwell, roe, talc, thecla, ure, wyvern, zendic.

Brooks Passenger Locomotive for the Egyptian State Railroads.

The Brooks Locomotive Works have shipped to the Egyptian State Railroads an experimental passenger locomotive, having four-coupled driving wheels, a leading four-wheel truck and a pair of trailing wheels. As so arranged the drivers are 78 in. in diameter, but additional wheels are furnished for converting this engine into a ten-wheeler with either 60 or 90-in. driving wheels; that is, making an engine suitable for heavy passenger or freight service. The accompanying engraving shows this locomotive as a four-coupled engine, for which arrangement the following dimensions apply:

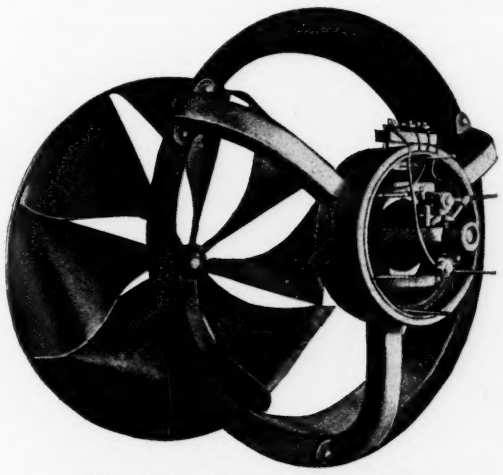


Brook's Passenger Locomotive for the Egyptian State Railroads.

Gage	4 ft. 8½ in.
Fuel	Bituminous (Welsh) coal
Weight on leading truck	37,000 lbs.
Weight on forward drivers	41,000 lbs.
Weight on main drivers	42,000 lbs.
Weight on trailing wheels	30,000 lbs.
Total weight of engine in working order	150,000 lbs.
Maximum weight of tender, loaded	91,000 lbs.
Total wheel base of engine	26 ft. 9 in.
Total wheel base, driving	7 ft. 1 in.
Total wheel base, engine and tender	54 ft. 1½ in.
Uniform length over buffers	63 ft. 6 in.
Height center of boiler above rails	8 ft. 11 in.
Height of stack above rails	14 ft. 5½ in.
Drivers, number	4
Drivers, diameter	78 in.
Material of centers	Cast steel
Leading truck wheels, diameter	36 in.
Trailing wheels, diameter	48¾ in.
Cylinders	20 x 26 in.
Valves	Improved piston
Boiler	Player Belpaire wagon top
Boiler pressure	180 lbs.
Firebox, copper	Long, sloping over frame
Tubes, brass, diameter outside	2 in.
Tender	Eight-wheel, steel frame
Tank, water capacity	4,800 gallons
Tank, coal capacity	6½ tons
Type of end frame	13-in. steel channels
Truck, capacity	100,000 lbs.
Tender wheels,	36-in. diameter, cast steel centers, with steel tires
Type of draw gear	Heavy screw coupling and buffer
Brakes	Automatic vacuum, with outside equalizer brake on all drivers and trailing wheels.

A New Type of Electric Propeller Ventilating Fan.

The B. F. Sturtevant Co., of Boston, has, during the past year, remodelled its enclosed motors designed for direct connection to propeller fans and is now building a full line of these useful machines, ranging from 18 in. to 120 in. in diameter, with capacities from 2,000 to 175,000 cubic ft. The motor is of the bi-polar type, entirely enclosed, and thereby protected from dust; a most important element in a machine used under these conditions. In order to avoid the excessive temperature which is incident to the operation of most enclosed motors, this type has been very carefully designed, so that a low temperature rise can be maintained without greatly increasing the size and weight above that of the ordinary open type. This machine is capable of continuous operation for ten hours, with a maximum temperature rise not exceeding 60° F.



The Sturtevant Electric Propeller Fan.

Yokes extending out from the field ring support the armature shaft. The end casings are entirely independent and can be instantly removed to give access to the entire interior. The bearings and brushes can be reached by simply removing the caps in the center of the casings.

The brushes are of hard carbon, in holders of a modified reaction type, which allows of easy adjustment when it becomes necessary to reverse the direction of rotation of the motor. The bearings are self-oiling and self-aligning and fitted with composition sleeves, which are removable from the outer ends of the boxes.

The design of the propeller wheel is the result of an extended series of experiments with different types. The delivery edge is helical, and the form is such that the air is picked up at the inlet of the blade at low velocity, and, when well under the influence of the blade, accelerated to its maximum velocity with the least amount of slip. As a result, the efficiency is extremely high. The wheel is partially enclosed within a conoidal inlet ring, which decreases the frictional resistance to the entering air. By means of a tripod support the motor is accurately centered and rigidly held in place, and the entire apparatus may be bolted to the wall through which the air is to be discharged. The illustration serves to make clear the general features of the design.

Electric Works in Bombay.

Because of the great interest that attaches to the industrial development of India, a report of Consul W. T. Fee is printed at some length below, with extracts from a letter of the Municipal Commissioner of Bombay. This is probably the most explicit information yet furnished to Americans, on the conditions to be met in placing electrical equipment in India:

In all India, Madras is the only city where electricity is used as a power for street railroads. Bombay's tramways are run by horse power, and the city is lighted by gas. Electricity is used only in a limited way. The general merchant and dealer is not sufficiently acquainted with electric manufactures to make a successful agent, and the demand for goods of this line is quite limited.

Bombay is an immense city, with land and sea shipping equal to the best. It has large commerce and trade and manufacturing interests. Its buildings are said to be the finest in India, and much wealth is centered here. The appalling density of its population and the exorbitant rates of rental must find relief in cheap and rapid electric transit. Electricity as motive power and light must come soon, and I hope our manufacturers and capital seeking new fields of profitable and safe investment will look well to this opportunity.

The Bombay Tramway, an American company with head office in New York city, some time since applied to the municipality for the privilege of converting its power into electricity. This has not as yet been granted. The Municipal Commissioner, W. L. Harvey, has declared his intention of giving the city electric lighting, and the matter is now open for bids and offers. For the information of those interested, I inclose a letter from the municipal commissioner and a copy of preliminary contract on the subject of the electric lighting of Bombay. I might add that three or four local firms have tendered bids. These firms, I understand, are simply representatives of European capitalists and electric construction companies. I might further say that India possesses an inexhaustible supply of coal, and, while it is inferior to the Welsh coal, yet it is correspondingly cheaper and considered very good for steam purposes. It sells at this port for from 13 to 16 rupees ($4.25 to $5.25) per ton, according to the quality.

The cost of transportation of electric supplies and apparatus from our shipping ports to Bombay could be greatly lessened by freighting in sailing vessels around the Cape. This would also avoid Suez Canal tolls, and, by judicious management in shipping, the extra time taken would not be felt. Under the Indian tariff code, a large proportion of an electric plant would enter duty free. However, the question of tariff would not figure in competition for the contract, as all companies are treated equally.

I will do all in my power to aid and further American interests, and would impress upon any company wishing to enter upon this field the absolute necessity of sending reliable agents to represent it.

Extract From Letter of Municipal Commissioner.

It is open to any firm to apply for a concession, and any applications received will be put before the corporation. A copy of the agreement which it is proposed should be adopted and executed by any firm to whom the necessary permission may be given is herewith forwarded. The agreement is, however, by no means final, but is rather drawn up to form a basis of discussion.

It should be clearly stated over what area and in what streets cables are proposed to be laid, the size of the supply station, and what terms the applicants are prepared to offer.

The commissioner shall not in any case permit any electric supply lines to be set up and conducted either wholly or partially above ground, above, along, or across any street, road, or pavement. The Commissioner may limit the number of wires or cables which shall be laid down under any one street. The company may open and break up the pavement of the several streets, roads, and bridges vested in the corporation under which the Commissioner may have approved of lines being laid down, and from time to time repair, alter, or remove such lines. In case the Commissioner shall at any time consider that the position of any electric supply lines or other appliances ought to be altered, the company shall within seven days, upon the written requisition of the Commissioner, at their own expense, make such alteration.

The provisions of this agreement shall remain in force for a term of twenty-one years, and in consideration of the concession herein granted the company hereby undertakes to pay to the corporation half-yearly on the 15th day of March and the 15th day of September in each year an amount calculated at the rate of 200 rupees per annum for each mile of ground under, along, or over which electric supply lines shall for the time being be laid down; provided, however, that the company shall not be liable to make any payment in respect of the first year, and that, in respect of the second year from that date, the amount to be paid by the company shall be calculated at the rate of 100 rupees per annum only for each mile as aforesaid.

At the expiration of the term for which this concession is granted, or in the event of the company being desirous to dispose of their lines, with the plant and other things connected therewith, before the expiration of the said term (of which desire the company shall give notice in writing to the Commissioner), the corporation shall have the option and right of purchasing the same upon declaring through the Commissioner their intention so to do within three calendar months after the expiration of the said term or after the company shall have ceased to carry on their business; the amount to be paid in the event of such purchase shall be the fair market value of the land, buildings, works, materials and plant of the company at the time of the purchase, due regard being had to their nature, state of repair, etc., but without any addition in respect of compulsory purchase or of good will or of any past or future profits or of any similar consideration, such value in case the parties do not agree to be decided by arbitration.

The company shall not assign or transfer their right, interest, and property in the concession or their power of working the same without the previous consent in writing of the Commissioner.

The company shall deposit with the Commissioner the sum of 5,000 rupees in Government paper, which shall remain so deposited during the continuance of these presents, all interests accruing on the said sum to be credited to the company. The Commissioner shall from time to time be entitled to deduct all fines, expenses, costs, or sums of money which may under the provisions of these presents from time to time become payable to him by the company out of the sum so deposited or the interest accruing thereon; provided always that if the said sum of 5,000 rupees shall become exhausted, the company shall within fourteen days after notice shall have been given to them by the Commissioner deposit a further sum of 5,000 rupees with the corporation.

If at any time during the term for which this concession is granted any system of electric lighting, being a substantial and acknowledged improvement upon the system in use by the company, is developed and introduced in England, America, or elsewhere, or if any substantial improvement in the cables, apparatus, or fittings connected therewith is in like manner developed and introduced, the company will at their own expense in all respects, upon every reasonable requisition by the Commissioner in that behalf, introduce such improvement and apply the same to their electric supply lines apparatus for fittings to be laid down, erected, or fixed under these presents.

Nothing in these presents contained shall be construed as conferring any monopoly or exclusive right in favor of the company to establish and work electric supply lines for lighting or power under or through any of the public streets of the city.

If any doubt or dispute shall arise between the company and the corporation touching the construction of these presents, it shall be referred to the arbitration of three indifferent persons, one to be from time to time chosen by the company and another by the Commissioner, and a third to be named by the two persons first chosen, and the decision of such arbitrators, if they agree, or of such umpire, if they disagree, shall be final.

TECHNICAL.

Manufacturing and Business.

Universal car bearings are specified on the 250 coal cars recently ordered by the Choctaw, Oklahoma & Gulf.

The Light Inspection Car Co., Hagerstown, Ind., recently sold a velocipede car to Joseph Flory, Chairman of the Missouri Railroad and Warehouse Commission, who is a candidate for Governor. Mr. Flory will make a tour of the State on this car.

Mr. J. W. Duntley, President of the Chicago Pneumatic Tool Co., Chicago, Ill., has returned to Europe for an extended stay at the Paris Exposition, and invites customers and friends of the company to call on him in the American Machinery Building, Vincennes, in Space 1, Block 9, or at the Palace of Machinery and Electricity, Champ de Mars, Space 1, Block 14.

We are informed that the New Navy Brand Asbestos Fire Felt Covering, made by the H. W. Johns Mfg. Co., of New York City, has been adopted for the pipe work in the New York State Capitol Building, to replace the present covering. The contract amounts to over $4,000. The company has also secured the pipe and boiler covering work for the new addition to the Manhattan Hotel, at Forty-second street and Broadway, New York City.

The Locomotive Appliance Co., Mr. Ira C. Hubbell, President, has just been organized, which company will put a new form of valve gear on the market. The headquarters temporarily are in the Temple Block, Kansas

City, Mo., but after August 1 the permanent headquarters of the company will be in Chicago. This valve gear is adapted to either locomotive or stationary engines, and a model was shown at the Saratoga conventions and attracted much attention. By a slight modification of the existing valve gear, a steam distribution is obtained quite similar to that got with Corliss engines. Tests have been made on the locomotive testing plant at Purdue University which confirm the expectations of the inventors.

Iron and Steel.

The Carnegie Co. has a contract to supply 4,000 tons of 65-lb. rails for the Cape Government Railways.

Advices from Pittsburgh indicate a drop in the price of steel billets to $22 and $23 per ton for immediate delivery.

It is stated that the attempt to form a consolidation of a number of valve manufacturing concerns of Pittsburgh and Allegheny has been abandoned, as the options have expired.

Frank E. Kirby, for a number of years Chief Engineer and Designer for the Detroit Dry Dock Co., and lately connected with the American Ship Building Co., resigned on July 1. It is understood that he will locate in New York as a civil engineer.

Conferences were held in New York City last week by officers of the larger steel companies to consider the general condition of the market and to agree on prices. President Gary, of the Federal Steel Co., gave out a statement which covers the situation in a general way: "The conferences between the presidents of the leading steel and iron companies were wholly informal. The questions discussed relate to the general condition of the iron industry, including supply and demand and present and future prices. The purpose was simply to get information concerning the exact situation and to exchange views in regard to individual business policies. The feeling prevails that as to many products prices have about reached the bottom, and although it is generally believed the prices of pig iron and billets are at present high in proportion to some of the finished products, and should be reduced to some extent as soon as circumstances will permit, I think prices will rapidly adjust themselves to the entire satisfaction of the producer and the consumer. The disposition of manufacturers to consult from time to time one another as well as their larger customers, thus following the example of the presidents of all the leading railroads, should result in benefit to all concerned."

In the issue of July 5 the *Iron Age* says about the situation of the iron and steel market: "Half the year has gone and the time has at last arrived when most of the contracts placed by large consumers for pig iron and finished products have expired. For the past 90 days the end of June has been anxiously awaited by manufacturers who believed that the good condition of the country at large would certainly lead to the general renewing of contracts. It is disappointing to find that elements have entered into the situation which have completely upset all calculations. The downward tendency in prices was for awhile strongly resisted by those having contracts to fill for the first six months in order to protect not only their own business but also that of their customers, whose prices, on their own products, would, of course, be unfavorably affected by declines in raw material. The decline which set in, despite such resistance, has gone considerably further than had been expected when it began. We have had very heavy reductions since the height of the market was reached last October, in some cases amounting to 50 per cent., and in others from 30 to 40 per cent. In the past week rapid progress was made in getting down to bottom prices. Tubular goods were reduced 20 to 25 per cent., and further cuts were made on pig iron, steel billets, plates and bars."

Heavier Passenger Locomotives for the Santa Fe.

Under the direction of Mr. John Player, Superintendent of Machinery, A., T. & S. F. Railroad, a new type of passenger locomotive for mountain service is being designed. The design will include the main features of passenger engines now working in the mountains upon this railroad, but the total weight of locomotive will be greater, the cylinders will be 20 in. x 28 in., the driving wheel centers 60 in. in diameter, with a total diameter of 67 in. outside of tires. These locomotives are intended for service between Winslow and Barstow on the Santa Fe Pacific. There the ruling grades are 75 ft. per mile on one section of over 100 miles in one direction, and in some places the ruling grade is as great as 90 ft. per mile in the other direction.

The Big Locomotives Doing Well.

Information has been received in regard to the working of Pittsburgh, Bessemer & Lake Erie engines Nos. 150 and 151, described in our issue of June 29. The engines have been in continual service since received from the builders and are steaming freely and giving satisfaction. They are in drag service, hauling ore from Conneaut Harbor to Albion, a distance of 14 miles. Their total trainload is 2,373 tons, of which 1,775 tons are ore. From Conneaut Harbor to State Line, a distance of about four miles, a helper engine having 19 in. x 26 in. cylinders is used. The maximum grade between these points is a trifle over 40 ft. per mile, one-half mile having a 7° curve, the work thus being equivalent to similar performance upon a grade of 52 ft. per mile of straight track. From State Line to the E. & P. crossing, a distance of 8 miles, there is an average curvature of 1° and 40 minutes, with a total rise of 20.8 ft. The average grade is 26 ft. per mile, and the maximum grade 40 ft. per mile, the greatest length of maximum grade being 1¼ miles. Over this section, and from the E. & P. crossing to Albion, where the grades are about the same, the trains are taken without helper engines. The engines are carrying 215 lbs. of steam. There has been no trouble thus far from running hot.

Master Car Builders' and Master Mechanics' Associations.

Mr. J. W. Taylor has been re-elected Secretary of the Master Car Builders' and Master Mechanics' Associations to serve during the ensuing year. A list of the other officers was published in our issue of June 29. As is well known, the Executive Committees select the Secretary, and, therefore, Mr. Taylor's election was not known when the names of the other officers were announced.

Car Heating Patents.

We have the following from the Consolidated Car-Heating Co.: "Judge Pagnuelo, of the Superior Court of the Province of Quebec, Canada, on June 28th, rendered a decision in favor of the Consolidated Car-Heating Co. in its suit against the Gold Car-Heating Co., through its Canadian agent, Frank E. Came. The suit was to prevent the use and sale of the Gold Straight Port Coupler. The decision sustains the Sewall patents, grants an injunction against the sale and use of the infringing coupler, awards damages and assesses costs on the defendant."

Bracket on the Head of Main Reservoirs.

The Westinghouse Air Brake Company issues the following notice: "Some years ago, when main reservoirs of comparatively small capacity were generally employed, and but very few standard sizes were made, a bracket was bolted on one end of the reservoir to facilitate its application, especially when located between the engine frames. This style of reservoir is illustrated in many of our publications, and particularly in our 1897 Catalogue, on Plate F23, Fig. 1, which naturally leads to the impression that the construction indicated is standard. The greatly increased number of different sizes of main reservoirs now called for by our patrons, however, and the various locations on the locomotive in which they are installed, render this bracket on the head entirely useless in the large majority of cases; and, in view of this fact, it will be hereafter omitted in every instance unless distinctly specified."

Traveling Engineers' Association.

The Traveling Engineers' Association has sent out a letter of inquiry on the subject of smokeless firing, and replies should be sent to Mr. J. H. Burns, Assistant Master Mechanic of the Burlington, Cedar Rapids & Northern, Cedar Rapids, Iowa. The following questions are asked:

Have you experimented in firing locomotives with soft or bituminous coal without emitting black smoke? If so, what has been your success, and how accomplished?

Have you experimented in firing locomotives without black smoke through efforts and skill of the engineers and firemen only? If so, on what theory did they fire and operate the engine?

What, in your opinion, is smokeless firing? Does it admit of any smoke, or is brown or gray smoke tolerated, and dense black smoke only considered poor firing?

Do you claim a saving in fuel by smokeless firing? If so, what per cent.?

Can smokeless firing be accomplished by any device known to you, without skilful firing?

Can an engineer aid in smokeless firing by the manner in which he operates his engine?

If you are not using the system of smokeless firing, what are your reasons for not doing so?

Do you consider that smokeless firing will be of sufficient advantage, apart from reasons of economy, in added comfort to passengers and safety to employees to warrant its adoption?

Can as good results be obtained by skilful firing without devices as with them? What is your opinion of an arch as effecting smokeless firing?

Do you get the same results as to smokeless firing from all grades of bituminous coal?

Interlocking.

The State Railroad Commissioners of Illinois have apportioned the cost of installation and of maintenance of interlocking signal plants at Atlanta and Minier, the roads interested being the Chicago & Alton and the Terre Haute & Peoria, in each case; also at Shattuck at the crossing of the Baltimore & Ohio Southwestern with the Jacksonville & St. Louis.

Block Signals Between Providence and Worcester.

Readers interested in the history of automatic block signaling will recall that the Providence & Worcester Railroad, now the Worcester Division of the New York, New Haven & Hartford, was one of the earliest roads to be equipped with Union automatic track circuit signals. These signals were not continuous, however, most of the sections being at or near stations. But the stations are very near together throughout the 44 miles of road, and especially near the southern end, and the gaps between the sections are now being signaled so as to make a continuous block system. The signals now being erected are those which were recently taken out of the Providence Division to make way for electrically controlled manual signals.

Interlocking on the New York Central.

The low pressure pneumatic interlocking plant at Hoffman's, the new junction of the West Shore and the New York Central main line, west of Albany, is now completed. This is a 20-lever machine made by the Standard Railroad Signal Company. The Central has also just finished a 36-lever mechanical interlocking plant at De Witt. This road now has mechanical interlocking signals at Lyons, Canastota, Rome, Little Falls, St. Johnsville, Fonda, Amsterdam, Karner (east end and west end) West Albany (east end) and east of the passenger station at Utica. Work is now in progress on the 96-lever low-pressure pneumatic interlocking plant at Suspension Bridge.

Nickel Steel on Locomotives.

The Northern Pacific has specified Bethlehem nickel steel for the driving axles and crank pins for 20 locomotives now under contract with the Schenectady Locomotive Works, and the Bethlehem Steel Company has already booked orders for the forgings in question. The latter concern reports that the list of railroads using this material is steadily growing, but calls attention to the fact that those wishing to specify it for locomotive forgings should be careful to designate it as "Bethlehem Nickel Steel," as the reputation gained by it has resulted in the production of inferior imitations.

THE SCRAP HEAP.

Notes.

The Pan-American Exposition Co., which is to hold a fair at Buffalo next year, reports the receipt of $150,000 from the New York Central & Hudson River Railroad and $15,000 from the Pennsylvania.

The Cleveland, Cincinnati, Chicago & St. Louis is experimenting with willow hoops for the delivery of "19" train orders to moving trains. The stick by which the stationman holds the hoop is about 4 ft. long.

The proprietor of a flour mill has been expelled from the Minneapolis Chamber of Commerce, and the members of another firm have been indefinitely suspended, for manipulating the bills on grain which was brought to their mills over the Minneapolis & St. Louis to be reshipped on milling-in-transit rates.

A man is held for trial in Brooklyn, N. Y., on a charge which may land him in state's prison, when the only offense of which he is accused is tearing up a few rods of the track of a miniature railroad at Coney Island. The train probably never runs faster than six miles an hour, but the seriousness of the man's case arises from the fact that the railroad, though very small, is not, as one might at first suppose, a mere toy railroad. A locomotive weighing about 500 lbs. hauls nine cars, carrying four children each. The accused had been discharged from his position as engineman on this road, on account of drunkenness, and in revenge he tore up some of the track. He was brought before Magistrate Voorhees, who, after learning the facts, said that, according to the law, the crime was the same as it would be in the case of tampering with a standard railroad. This is in accordance with Section 635 of the Penal Code.

Traffic Notes.

The suit of the state of California against the Southern Pacific to forbid an advance in passenger fares from San Francisco to Fresno and other towns in the San Joaquin Valley, has been decided in favor of the state, but it is said that the railroad company will appeal to the higher court.

An Effective Advertisement.

At the new passenger office of the Southern Railway, at Broadway and Twenty-eighth street, New York city, a map of the lines of the road has been painted on the largest plate glass window. The drawings were made by the American Bank Note Company on paper, and these were transferred to the glass by expert painters. The window is 12 ft. in height, and the map covers 140 square ft. of space. It includes the territory within the bounds of the Potomac River, the Atlantic seaboard, the Gulf of Mexico and the Mississippi River; and there is also a map of Cuba, Porto Rico and the Bahamas. The field of the map is translucent, the waters blue tinted, the railroad lines red and the lettering black. Every important town on the system and its connections is conspicuously represented.

Work of Traction Engines in South Africa.

The London *Times* of recent date gives an account of work done in South Africa by traction engines belonging to the British army. Seven of these engines have been used in hauling stores across the veldt. The seven engines carry 5,000 ton-miles of freight daily, which is equivalent to each engine hauling 35 tons over 20 miles. In the wild country where this work is done, transportation by ox teams costs 78 cents per ton per mile, so that each steam engine is earning, on that basis, over $500 a day, and it is estimated that a machine will pay for itself in 10 days. Going on to commend traction engines generally, the writer remarks that in England country roads much traversed by these engines are always smoother than those which are traversed only by horses and narrow-tired wagons. Bicycle riders always notice this fact.

New Railroad in West Poland.

The Consul General at St. Petersburg, Russia, under date of May 9, writes that the Warsaw-Vienna Railroad Co. has been authorized to build a line from Warsaw via Lodz to Calish and Skalmerjitze. The authorized capital is 125,000 shares of $50 each, and 4 per cent. bonds without the Government guarantee. The shares mature in 1932, and the bonds in 60 years. The line is to be about 165 miles long, and be completed within three years.

The New East River Bridge.

The steel tower on the Manhattan side of the new East River Bridge has been finished to its full height of 329 feet above high water mark. The Williamsburg tower is nearly completed. Arrangements are under way for starting the girder work. The contractors for the cable work will begin operations as soon as the steel towers have all the girders in place.

The Chief Engineer of the New East River bridge in a recent report said that the clearing up of rubbish and pumping water out of the anchor chain tunnels has been finished. Except for dismantling the travelers, the anchorage is in the shape required for the cable-making plant. Steel towers and end spans—the K column sec-

tions have been put in place on the Manhattan main tower. One more section remains to be built before the saddles are set. The supply of rivets is now ample, and riveting is proceeding satisfactorily. On the Brooklyn main tower a number of main braces between the legs have been riveted. Riveting here is also satisfactory; the erection of the column sections will be continued the coming week. Some riveting has been done on the intermediate towers on both sides of the river. The false work for the cantilever span in Manhattan is being framed and erected.

The bids for the approaches, opened May 31, have been rejected. Chief Engineer L. L. Buck is now in Europe. Engineer O. F. Nichols will be in charge during Mr. Buck's absence.

The Finance Committee of the Board of Aldermen has reported in favor of providing for an issue of corporation stock for $4,000,000 for continuing the work.

N. Y. C. Station at Desbrosses Street.

In about two months the New York Central & Hudson River Railroad will have at Desbrosses street, on the North River, New York city, the largest railroad freight pier in the city. The main pier is now nearing completion. It is 846 ft. long and 60 ft. wide. The building on the bulkhead is 153 ft. x 45 ft. The second floor of this building will be occupied by the offices. This station, like the other water-side stations in the lower part of the city, will handle freight which is taken to and from the railroad terminus of the company, at 60th street, about three miles up the river, in cars on floats. The Desbrosses street station will be able to handle about 160 carloads a day. This will relieve St. John's Park, which is not far from Desbrosses street, and to which cars are run from 60th street directly on tracks laid in the street. On the new pier there will be a traveling crane capable of lifting 10 tons.

At the Barclay Street Station of the New York Central, farther down on the river front, the company is now putting up the superstructure of two new piers. Each of these piers is 750 ft. long and 55 ft. wide, and they are connected by a bulkhead 365 ft. long x 45 ft. wide. This station will have a capacity of 200 carloads a day.

English Street Railroad Developments.

Much of the trolley line equipment now proceeding in England has been brought about by private promoters, whose endeavors to secure concessions have led local authorities to carry out schemes of their own. Promoters have expended large sums of money to attain their object, only to be overruled by the opposition of municipalities. The British Electric Traction Co. has had many such experiences as this, for its enterprise has taken it into nearly every town of importance in the country. It has not all been failure, however, for many good concessions have been secured, and some of the lines are now in operation. With a capital of £1,300,000 subscribed it has earned during the last 15 months a profit of £159,122, and after deducting expenses has a profit of £130,174 net. The concern is in its youth, but it has paid ordinary stockholders 8 per cent. per annum, and its operations are so extensive that over a million sterling is soon to be raised. One of the principal businesses of this company has been to buy up old horse tramways, and bring them up to date by the adoption of electricity. Some of its largest undertakings are of the inter-connection of several towns and districts in South Staffordshire, and other great industrial centers.

London & Northwestern 4,000th Engine.

On June 15 the great majority of the L. & N. W. R. R. left work at mid-day for a day's holiday with wages, this arrangement being made to celebrate the completion of the 4,000th engine in the Crewe Works. Twenty thousand out of the 78,000 employees are in the locomotive department, and 8,000 are in the Crewe Works. The 4,000th engine was named La France, and is now at the Paris Exhibition. In honor of this event Mr. Webb has had the freedom of the borough of Crewe conferred upon him.

The Trolley in Italy.

The Adriatic Railroad Co. is about to apply the trolley system on its line from Lecco to Chiavenna and Sondrio, 66 miles of line. Hydraulic power will be taken from the river Adda, near Morbegno. The electrical machinery has been ordered from a Hungarian firm.

New Zealand.

Considerable changes are being made in the working of the New Zealand Railroads. The "parliamentary" fare of a penny a mile is being adopted, with low rates for tourist tickets all the year round. The electric train staff apparatus and the Westinghouse brake are being adopted. A superannuation fund for the employees will shortly be made.

A Railroad Battalion in Turkey.

The railroad battalion which is about to be formed in Turkey, and to which the construction of the Damascus-Mecca Railroad will be intrusted, will consist of 600 officers and men. The Ministry of War has asked the Ottoman Ambassadors abroad to send reports on the organization of similar services in the European armies.

To Condemn Land for the Memorial Bridge.

A. A. Wilson, Thomas W. Smith, and Henry F. Blount, of Washington, D. C., have been appointed Commissioners to appraise and condemn land along Rock Creek Park, and in line with Massachusetts avenue extended, for the use of sidings, slopes, and embankments of the proposed memorial bridge.

South American Notes.

The construction on the Argentine Northeastern Railroad is making progress. The bridges have been finished over the rivers Colorado, Aguape and Cuay Grande. The bridge over the Aguape is 1,285 metres long. The whole line will be finished in three or four months.

Prehistoric Water Works in New Mexico.

"A remarkable system of reservoirs and aqueducts has been discovered in New Mexico, some of which are situated about eighteen miles west of Santa Fe. These seem to prove that an advanced system of irrigation, unparalleled at this age, was in use there thousands of years ago. Under the lava, which covers hundreds of square miles, are found traces of cemented ditches, and reservoirs that are marvels of civil engineering. The ancient builders provided against seepage by cementing the bottoms of their ditches whenever they were conducted across loose soils. Their ditches wound in and out at the base of mountain ranges, following the sinuosities of canyons, and rounding points in such a manner as to catch all the storm water before it was absorbed by the loose sands at the mountains' bases. Reservoirs at convenient basins stored the water. Chasms were crossed by viaducts, and wonderful engineering devices were used for the removal of silt, that might be used as an aid to the fertility of loose and rocky soils, otherwise valueless. Into some of the ditches lava has run—showing their great antiquity. Others are now covered with shifting sands; but enough are still visible in many places in New Mexico to enable the skilled engineer to understand the system which prehistoric New Mexicans rendered so effective."—Exchange.

Without vouching for its correctness, the above information is forwarded to the patient searchers for water, along the lines of railroads in New Mexico.

An Odd Kind of Shyster.

In Austria a peculiar business has grown up, namely, agencies for collection of overcharges on freight, due to improper classification, etc. That these agencies have their weak points is indicated by a report of the Chamber of Commerce in Graz, in answer to a government inquiry. Many such agencies, it reports, do not resist the temptation to criminal falsifications. On investigation some of them have been found equipped with a veritable laboratory for forgery—chemicals, all sorts of inks and pens, etc. Railroad employees entrusted with computing freight bills have been bribed to make the amounts too great. Then, aside from these processes, the agencies often demand restitutions out of all proportion with the excess charges or the damage suffered. This Chamber of Commerce urged that such agencies should be required to take out a government license, and that no license should be granted without consulting the local Chamber of Commerce as to the character of the applicant. It also advises that those engaged in business as forwarders (through whom a large part of the smaller freight shipments are made) shall not be entitled to make any claims—this being doubtless because, as experts, it is their business to know what the proper charge is before accepting bills of lading. In one district of Austria, where the freight shipments are by no means important, there are no less than 13 of these claim agencies. They usually are paid by a commission on their collections—half or two-thirds of it sometimes; and it seems that they are bound to find something to collect.

If their energy is equal to their unscrupulousness, we should like to see a pack of these fellows put on the trail of a few American freight claim departments for a brief season; just for a little while, to give certain G. F. A.'s a taste of the punishment that they deserve!

Electric Railroad Exhibition in London.

The Light Railways and Tramways Exhibition, which opened in London, on June 22, was a most successful affair. American car and motor builders, and trolley line equipment suppliers, were not slow to make use of so excellent an opportunity for bringing their work before the London councillors and municipal officials from all parts of the country, who are taking a great interest in the various systems seeking guidance as to the ultimate placing of large contracts. The most imposing exhibit, and one which commanded much attention, was a short length of Westinghouse sectional conduit tramway which was kept in operation from a small gas-driven power station which occupied one corner of the Exhibition Hall. It is thought certain that this show has had an important effect in dispelling that lamentable ignorance which has characterized London districts in regard to the subject of electrical street railroads. The London County Council now estimates that by converting its horse lines to electrical it will make such an economy in operation and carry such large traffics as to produce a greater profit every year of £526,000, which means a reduction of 3½d in the £ on the rates, or 40 per cent. in passengers' fares.

Engineering Opportunities in China.

In summarizing the engineering status and the urgent needs of China, Mr. William Barclay Parsons, in *The Engineering Magazine*, for July, says: "If, therefore, I were asked to enumerate the relative importance of engineering development, I should reply—means of transportation; hydraulic machinery; mining; and then, those machines which can compete against a very low-priced manual labor, and which can, if possible enter a field of work not now undertaken, such as electric lighting, or enter the existing fields so as to change present conditions without too violent or immediately revolutionary effects."

Traffic on Chicago Elevated Roads.

The traffic on the South Side and Metropolitan elevated roads, Chicago, still continues to increase. In the month of June, last, an average of 67,892 passengers were carried daily on the South Side elevated and 82,206 passengers on the Metropolitan. The daily average by months so far this year, with a comparison with 1899, is given below for both roads:

South Side Elevated.

	1900.	1899.	Increase.
January	69,504	58,762	10,742
February	70,050	60,292	9,758
March	72,264	63,909	8,355
April	71,665	63,878	7,787
May	68,296	59,588	8,708
June	67,892	56,117	11,775

Metropolitan Elevated.

	1900.	1899.	Gain.
January	88,585	72,338	16,247
February	92,618	75,344	17,274
March	94,508	79,243	15,265
April	90,430	77,464	12,966
May	86,288	75,890	10,398
June	82,206	72,433	9,773

Fatal Street Car Accident.

Two persons were killed and about 20 injured in a butting collision of electric street cars at East Webster, Mass., on July 4. On the night of the same day one was killed and 16 were injured in a heavily loaded electric car which was derailed at a curve near Harrison, O.

Train Accident and Oil Explosion at Parkersburg.

A slight freight train collision on the Ohio River Railroad, at Parkersburg, W. Va., on the morning of July 4, about 4 o'clock, ruptured a tank car containing oil and set the oil afire. The fire was not extinguished and a large crowd of spectators gathered to view the work of clearing up the wreck; and about 7 o'clock the tank exploded and the fragments were hurled several hundred feet in different directions. Six persons were killed, including General Superintendent Hamilton, Master Mechanic Lalime and four other railroad men; and a dozen other men were injured, some of them being railroad employees and some city firemen. About 40 spectators, including some children, were slightly injured. Many persons in the crowd were deluged with falling oil, but were not burned.

Rear Collision at Slough.

In a rear collision of passenger trains at Slough, on the Great Western Railway of England, June 16, three passengers were killed and 40 injured, of whom 16 had to be taken to a hospital. The foremost train, heavily loaded with passengers going to the races at Windsor, was standing at the station. Our English exchanges give incomplete accounts of the collision, but it appears that the engineman disregarded both a home and a distant signal set against him. The case is somewhat remarkable from the fact that the engineman has been in the service of the company 42 years, and never before caused an injury to any person. A coroner's jury, after investigating the circumstances, rendered a verdict to the effect that this engineman was at the time suffering from "mental aberration." His age is 59. It is said that it is 25 years since a passenger has been killed on the Great Western in consequence of an engineman over running signals, and ten years since a passenger has been killed on the road, from any cause, in connection with the running of a train.

Electric Car Disaster at Tacoma.

On the morning of the Fourth of July a street car, which became uncontrollable on a grade at Delin street, Tacoma, Wash., fell down a high bank and was crushed. The car was packed full and 41 of the occupants were killed. Sixty-two others were injured. The car fell about 75 ft. in a practically perpendicular line and landed bottom upwards; it was then overturned and parts of it fell still farther.

A Steel Car in an Accident.

A railroad officer writes: "Referring to your letter, we had an accident caused by a loose wheel under one of our steel coal cars, capacity 50 tons; the loose wheel causing a derailment which resulted in the steel car being damaged, as it was cornered by other cars in the train. The steel car came out of the accident in much better shape than a wooden car would have done under the same circumstances."

Workmen's Trains in England.

The British Board of Trade has issued a blue book of 338 pages showing the number of workmen's trains run on the roads of the United Kingdom, and the fares charged. Workmen's trains of some kind are run, on more than one-half the roads, at least one day in the week, and the great lines leading to London run them by the score. The London & Southwestern runs 133 trains of this kind into the metropolis every morning, the Great Eastern 104, and other companies in proportion. The London & Northwestern runs 246 daily workmen's trains to cities other than London. The number of trains which these companies are required, by the special law, to run for workmen is very small, from one to five daily, so that it appears that the companies favor the working men far beyond the Parliamentary requirement. The fares for working men on these trains are exceedingly low. Tickets are sold for one week. For distances of four miles or under, the daily fare (round trip) is only four cents. Two cents is added for each additional three miles up to 15 miles; or, for the longest distance, about 3¾ mills per mile. *Herapath's Journal* declares, on the authority of Lord Claud Hamilton, that these fares are less than the cost of the service. A statement is presented showing the number of workmen's tickets issued by the principal companies in 1899, but the reader is left uncertain whether this shows the number of journeys, the number of weekly tickets, or the average number of workmen traveling. The Southeastern & Chatham, which issued 4,782,000, sold about one-half this number of tickets at the rate of four cents for a round trip.

Fewest Failures for Eighteen Years.

Despite the quieting down of general business there has been little appreciable increase in business mortality, and the number of failures reported for the first six months of the calendar year 1900 is the smallest noted for eighteen years past. Compared with a year ago the falling off in number is 3.3 per cent., while compared with 1898 the decrease is 25 per cent., and even larger decreases are noted when comparisons are made with the first half of the years 1897 and 1896. This year, in fact, for the first time in eighteen years, the six months' failures have fallen below 5,000 in number. The volume of liabilities is somewhat larger than a year ago, the increase being nearly $10,000,000, or 19 per cent., but, with the exception of the first six months of last year, the aggregate liabilities of the 4,880 failing traders, $60,064,208, is the smallest sum involved in the period mentioned since the year 1892, and, with that exception, is the smallest aggregate reported since 1887.—*Bradstreet's.*

Electric Drive Patents.

We have the following from Mr. Charles W. Knapp, President and General Manager of *The Republic*, St. Louis: "In your issue of June 23 an item appeared stating that a decree has been entered in the case of the Bullock Electric Manufacturing Co. vs. Publishers, George Knapp & Co. sustaining the validity of the Bullock Company's teaser patents and ordering an injunction. I cannot imagine from what source this information reached you, but can advise you that there is absolutely no foundation for the story. The suit of the Bullock Co. against publishers: George Knapp & Co. is still pending in court, and has not yet come to trial."

Hydraulic Railroads.

Another freak railroad scheme has been brought out in England, its principle being that the train constantly runs down hill. The track is built in sections with hydraulic or other power, so arranged that as soon as a train enters a section that end of the section is lifted up so as to make a gradient down which the train may roll to the next one.

This reminds us of the invention of a minister in New York, who wanted the elevated railroad structure converted into an aqueduct. Then trains of boats could be started in Westchester and slip pleasantly down to the Battery.

Loss of 40,000 Barrels of Oil.

At Bayonne, N. J., on the west side of New York Harbor, a tank of the Standard Oil Company was struck by lightning at 1 o'clock on the morning of July 5, and the oil was set afire. The resulting conflagration was not subdued for nearly 48 hours, and 25 tanks, all filled, were consumed. The loss was estimated at over $3,000,000, on which there was no insurance. The several tanks were more or less isolated, so that the fire spread slowly; and the company was prepared with various expedients to battle with the flames, but these were insufficient. The Bayonne water supply was exhausted and a large oil pump was set up to furnish a supply of water from the sea.

Dominion Railroad and Canal Appropriations.

Below we give a list of the most important of the proposed improvements on the International Ry., with an estimate of the cost as scheduled in the supplementary estimates submitted to the Dominion Parliament. To increase facilities along the line, $112,800; to buy tools and machinery, $66,000; to increase accommodation at Levis, $110,000; additional sidings along line, $105,500; through traveling steam derricks, $30,000; a new steel bridge at Etchemin, $22,000; increase accommodation at St. John (revote, $150,000), $203,000; dredge and blast

rock at Halifax, $11,000; raise Sydney & Louisburg Railroad, $3,300; to improve ferry service at Strait of Canso, $250,000; to extend the Intercolonial Ry. to Copper Crown Works, Pictou, $20,000; rolling stock, $400,000; new rails and fastenings, $420,000; towards strengthening iron bridges (revote), $80,000; building new and enlarging old engine houses (revote, $52,000), $60,000; towards building sea wall in Cape Breton (revote), $8,000; to provide large turn-tables (revote), $11,000; improvements at Mulgrave (revote), $10,000.

Some of the estimates submitted for canal work are as follows: Welland Canal, swing bridge at the fourth concession, Humberstone (revote), $15,000; Lachine Canal, enlargement, $25,000; Trent Canal, construction, $300,000; Rapide Plat Canal, enlargement, $155,000; Farran's Point Canal, enlargement, $60,000; Galops Canal, enlargement (upper entrance), $60,000; Welland Canal, general repairs, $30,000; to renew entrance piers, Port Colborne (revote), $20,000; Ottawa river, survey in view of improvement to navigation, $10,000; military buildings at Ottawa, $25,000, of which $19,000 is a revote; St. Andrew's Rapids, Red River, revote of $125,000; Levis graving dock, lengthening dock (revote), $85,000; Montreal harbor, lower division, improvements below St. Mary's current (revote), $300,000; Port Colborne, harbor improvements (revote), $50,000.

For a Stone Dry Dock at New York Navy Yard.

Rear Admiral Endicott, Chief of the Bureau of Yards & Docks, has directed Civil Engineer Asserson, of New York Navy Yard, to make plans for a stone and concrete dry dock to be built there. An appropriation of $1,000,000 for this dock became available July 1. General plans, as already outlined, provide for a dock between 500 and 550 ft. long, with a depth of 32 ft.

Purdue University.

At a meeting of the Trustees, July 5, Dr. Winthrop Ellsworth Stone was elected President of Purdue University. In the opinion of those well acquainted with the new President and with the needs of the University, the position which was left vacant by the death of President Smart has been filled by one well qualified to discharge its duties.

President Stone was born in Chesterfield, N. H., in 1862. When 16 years of age he entered the Massachusetts Agricultural College at Amherst, graduating in 1882 with the degree of Bachelor of Science. He entered, in 1884, the University of Goettingen, Germany, where he worked in chemistry and botany for two years, receiving the degree of Doctor of Philosophy. He was then given charge of the Chemical Department of the Tennessee Agricultural Experimental Station, and, in 1889, was elected Professor of Chemistry at Purdue, which position he has since held. A few years later the Trustees made him Vice-President, in which position he was able to assist Dr. Smart with some of the routine work. Later, when sickness prevented the President from being at his desk, a larger proportion of the administrative affairs fell to Prof. Stone's share, and since the death of President Smart, which occurred in February, he has been the acting President. His appointment is, therefore, in the nature of a promotion, and the fact that it is a most satisfactory one to all members of the faculty is perhaps a sufficient guarantee that Purdue will take no backward step under his leadership.

At their recent meeting also, the Trustees promoted W. F. M. Goss, Professor of Experimental Engineering in charge of the School of Mechanical Engineering, to be "Dean of the Schools of Engineering." Under the new arrangement Prof. Goss will have an official interest in the schools of civil and of electrical engineering, as well as in that of Mechanical Engineering, which hitherto has had his entire attention. His new duties, however, will not require him to withdraw from the activities of the Engineering Laboratory.

The Humor of a G. P. A.

The Chicago, Burlington & Quincy is building a line in Montana down into the Big Horn Basin toward Yellowstone Park, and as the Crow Indian reservation is near at hand, a contract has been made with the red men for grading a section of roadbed. It is rumored that the General Passenger Agent of the Burlington remonstrated with the Chief Engineer for entering into this agreement, claiming that it would disturb his relations to the Western Passenger Association; competing lines would certainly complain if they were to find out that the Burlington had made a deal with the "scalpers."

The Manhattan Steamship Company.

This is the name of a company, with headquarters at 11 Broadway, New York city, which has been incorporated to run steamships between New York and the New England coast. The corporation appears to be a consolidation of a number of existing lines, the names of which are given as follows: New York & Portland Line, for Portland, Me.; New York & Bangor Line, for Rockland, Camden, Belfast, Bucksport and Bangor, Me.; New York & Halifax Line, for Yarmouth and Halifax, N. S., Cape Breton and Prince Edward's Island; New York & Cottage City Line, for Cottage City, Mass.; New York & St. John Line, for Bar Harbor, Eastport and Calais, Me., and St. John, N. B. All of the six steamships of the company will have accommodations for passengers. The President of the company is Mr. Richard Morrell.

New York City Tunnels.

The State Board of Railroad Commissioners will give a hearing, Aug. 1, at the Fifth Avenue Hotel, New York city, on the application of the New York & Brooklyn Union Transportation Co., and the New York, Brooklyn & Jersey City Rapid Transit Co. for permission to build tunnel railroads from Brooklyn to New York city and Jersey City under section 59 of the Railroad law.

LOCOMOTIVE BUILDING.

The Illinois Central is having 13 engines built by the Baldwin Locomotive Works.

The Allegheny Valley has ordered two switching and two freight engines from the Baldwin Locomotive Works. All will have 19 in. x 24 in. cylinders and 50-in. driving wheels. The switchers will weigh 110,000 lbs. and carry 160 lbs. steam pressure; the boilers will have 128 tubes 2¼ in. in diam. and 14 ft. 9¼ in. long; the fire-boxes will measure 74⅜ in. long and 34½ in. wide; and the tenders will have a capacity for 2,700 gals. of water and 4 tons of coal. The freight engines will weigh 114,000 lbs. on the driving wheels and 10,000 lbs. on the trucks; the boilers will carry a steam pressure of 150 lbs. and will have 154 tubes 2½ in. in diam. and 59 in. long; the fire-boxes will measure 108 in. long and 42 in. wide, and the tenders will have a capacity for 3,000 gals. of water and 7½ tons of coal. All the engines will have Westinghouse brakes, Janney couplers, Sellers' injectors, Crosby safety valves and steam gages and Nathan lubricators.

The Whitehall & Granville, specifications for the building of which have just been issued, will require two electric locomotives, each capable of developing 37,500 lbs. of tractive effort, at a speed of not less than four miles an hour, of being operated at a maximum speed of not less than 20 miles an hour, and of developing not less than 450 h. p. each; and one electric locomotive capable of developing 24,000 lbs. tractive effort, at a speed of not less than four miles an hour and of developing a maximum speed of not less than 20 miles an hour and not less than 300 h. p. The locomotives are all to be equipped with air-brakes and air whistles. These are to be furnished by the contractor. For copies of specifications, address Charles I. Baker, 10 Hall Bldg., Troy, N. Y.

CAR BUILDING.

The Wabash is in the market for 20 passenger cars.

The Portland & Rumford Falls is asking bids on 50 coal cars.

The Atlantic Coast Line is said to be in the market for freight cars.

The Baltimore & Ohio is reported in the market for two postal cars.

Minneapolis & St. Louis officials are receiving bids on some freight cars for the Iowa Central.

The Houston & Texas Central is having 114 freight cars built by the Barney & Smith Car Co.

Swift & Co., Chicago, are reported in the market for refrigerator cars. We have no official information.

The Mexican International has ordered 100 coal cars of 100,000-lbs. capacity from the American Car & Foundry Co.

The Delaware, Lackawanna & Western has ordered 1,000 coal cars of 80,000-lbs. capacity from the American Car & Foundry Co.

The Whitehall & Granville (an electric road) specifications for the building of which have just been issued, will require 15 standard box, 15 gondola and 5 coal or gondola cars, all of 60,000 lbs. capacity; four combination baggage and passenger motor cars, and eight second-class closed cars, four to be equipped with motors. All the passenger cars will be heated and lighted by electricity and equipped with maximum traction trucks, air-brakes and M. C. B. couplers. The equipment is to be furnished by the contractor. For copies of specifications, address Charles I. Baker, 10 Hall Bldg., Troy, N. Y.

BRIDGE BUILDING.

ALBION, MICH.—We are informed that at the election, July 2, it was voted to issue bonds for $14,000 to rebuild the bridge over the river on Superior street. Bids are now being received. The bridge will be about six rods long and of iron. C. W. Dalrymple, Mayor.

ARLINGTON, WASH.—A number of bridges, probably three, will be needed on the Arlington-Darlington extension of the S. & I.

ATLIN, B. C.—A steel bridge is proposed over Pine River by the British Columbia Department of Public Works.

AVOCA, PA.—Two bridges and two culverts are to be built in the new yards of the Erie & Wyoming Valley R. R., now building at Avoca.

BEAVER CITY, NEB.—Bids are wanted by the Furnas County Commissioners, until July 17, for two 30-ft. steel bridges, one 42 ft. and one 24 ft. bridge. T. F. Newton, County Clerk.

BOSTON, MASS.—The Secretary of War has approved the report of the Government Engineers in favor of the Cove street bridge to cross Fort Point Channel to South Boston. (May 25, p. 346.)

The Massachusetts Senate has passed bills to abolish the grade crossings of Blue Hill avenue and Oakland street in Boston.

BRANTFORD, ONT.—A steel bridge will be built over Grand River, according to report, by the Grand Trunk Ry.

CHICAGO, ILL.—John O'Neill is reported making plans for an ordinance for building an additional approach to the Taylor street viaduct. The approach is proposed on Fifth avenue and is estimated to cost $75,000.

DUBUQUE, IOWA.—A number of Dubuque County officers are reported to have visited St. Paul recently to get information regarding bridges, there being a number of bridges proposed in Dubuque County this season.

EVANSVILLE, IND.—Bids are wanted, July 26, according to report, for a number of iron bridges for the county. Louis H. Legler, County Auditor.

EVERETT, WASH.—The Great Northern Ry. has agreed to bridge Hewett street, near Federal street, and to build a 70-ft. highway bridge on Hewett near Fulton street. Temporary wooden structures will be built at once.

FRANKLIN, PA.—The Commissioners of Venango County, E. K. Smiley, Clerk, want bids, until July 13, at 2 p. m., for two stone bridges.

A company is being formed to build a bridge over Allegheny River at Franklin; also another at Big Rock, to replace present bridges.

GRAND DETOUR, ILL.—We are informed that the contract for grading and building the approaches to the Grand Detour bridge over Rock River is let to W. J. McAlpin, of Dixon, Ill.

GRANVILLE, N. Y.—See Troy, N. Y.

INDIANAPOLIS, IND.—Reports state bids for a new bridge over White street, at Udell street, and repairs to the Michigan street bridge, will soon be wanted by the Board of Public Works.

IRONDEQUOIT, N. Y.—The city has been granted a year's extension of time to build a bridge over Densmore Creek.

MILWAUKEE, WIS.—The Commissioners of Public Works want bids, until Aug. 7, for building the highway bridge over Milwaukee River from Grand avenue to Wisconsin street, commonly known as Grand avenue bridge. Bidders are to furnish their own plans and must furnish a bond for $21,000. Charles J. Poetsch, Chairman of the Commission. We recently had information that the bridge would be 1,425 ft. long.

MONTICELLO, MO.—Bids are wanted for a steel bridge with a 98 ft. span, until July 23, according to report. Geo. H. Roberts, Commissioner.

MORGANTOWN, W. VA.—Local reports state that an effort is being made to have a bridge built between Morgantown and Seneca over Falling Run.

NARIPOSA, ONT.—A steel bridge is proposed at this place. J. D. Weldon, Township Clerk.

NEWBURYPORT, MASS.—The matter of building a bridge at Curzon Mills will soon be taken up for consideration.

NEW CASTLE, IND.—John W. Whitworth, Chairman of the Board of County Commissioners, will receive bids until July 13, according to report, for a number of small steel county bridges.

NEW HAVEN, CONN.—Bids are wanted, until July 20, for the new drawbridge at Kimberly avenue, between Orange and New Haven, crossing the West River. C. W. Kelly, City Engineer.

OTTAWA, ONT.—A steel bridge will be built over Aqueduct street by the Canadian Pacific Ry.

See also Scrap item on "Dominion Railroad and Canal Appropriations."

PEORIA, ILL.—Bids are wanted, July 24, by the County Clerk at Peoria for a steel and iron bridge 115 ft. long in Jubilee Township over Kickapoo River. Bids are also wanted, July 25, for two steel and iron bridges, 60 and 70 ft. long, in Elmwood Township over a branch of the Kickapoo; also bids, July 24, for a 42-ft. steel bridge over a creek in Timber Township; also bids, July 26, for a 173-ft. steel bridge in Hollis Township. All piers are to be steel tubes filled with concrete. The work is to be paid for jointly by each township and the county. George C. Murray, Chairman of the Road and Bridge Committee of Peoria County. (June 22, p. 432.)

PITTSBURGH, PA.—Reports state that an electric railroad soon to be built in Reserve Township, will build a bridge over Dunlap avenue, crossing East street, at a cost of about $75,000.

George W. Wilson, Director of the Department of Public Works, wants bids, July 14, for inspection of steel to be used in building a bridge across the west branch of Nine-mile Run on the line of Forbes street.

PORT HURON, MICH.—The city has begun suit against the townships of Columbus and Casco, to compel them to build a bridge across Pine River on the dividing line of the two townships. The bridge was washed away some time ago.

PRINCETON, IND.—An iron bridge, 234 ft. long, according to report, will be built for the Evansville & Terre Haute over the Patoka River.

RICHMOND, IND.—Local reports estimate that the heavy rains since June 1 have caused damage to county roads, bridges and culverts amounting to $25,000.

ST. LOUIS, MO.—Receiver Barnard, of the St. Clair, Madison & St. Louis Belt R. R., has permission from the U. S. District Court at St. Louis to expend $35,000 on improvements to the Alton bridge.

SAULT STE. MARIE, MICH.—The City Council, according to report, has sold bridge bonds to the extent of $75,000.

STAUNTON, VA.—The County Court has ordered two iron bridges, one to be built over Moffatt's Creek on the Spotswood Road, and the other across the Jenning's Branch.

STOCKTON, CAL.—We are informed that application has been made to the War Department by San Joaquin County for permission to build a steel bridge 294 ft. long over San Joaquin River at Stockton. Address the County Clerk.

Bids are wanted, Aug. 7, by the County Clerk for a 72-ft. steel bridge over Calaveras River.

TOLEDO, OHIO.—The Maumee Railway Bridge Co. was incorporated in Ohio last month by Harry E. King, Chas. H. Tracy, both of Toledo, and Chas. F. Chapman, Jr., Harry W. Lloyd and Frank W. Caughlin, to build a bridge over the Maumee River.

TROY, N. Y.—Bids are wanted, July 20, by Charles I. Baker, 10 Hall Bldg., Troy, for building the Whitehall & Granville (electric) R. R., including a bridge and embankment in Whitehall over the D. & H., 920 ft. long. Also bridge and embankment in Granville over D. & H., 681 ft. long.

WATERFORD, ONT.—A steel bridge is proposed on Main street. Bids will be wanted as soon as the plans are made.

WHITEHALL, N. Y.—See Troy, N. Y.

WOODLAND, CAL.—The Southern Pacific Co. has notified the Yolo County Board of Supervisors that, on Jan. 1, 1902, it will begin to rebuild the drawbridge across the Sacramento River at Knight's Landing.

Other Structures.

ATLANTIC CITY, N. J.—The Pennsylvania R. R. has bought property at this place, upon which, it is stated, a new depot will be built.

BOSTON, MASS.—Fire in the repair shops of the Eastern and Western divisions of the Boston & Maine R. R. in Cambridge, July 28, is reported to have caused a loss of $10,000.

BROCKVILLE, ONT.—Fire in Cossitt's Bros.' foundry, July 1, caused a loss of about $300,000.

DURANGO, MEXICO.—The Durango Steel & Iron Mounting Co. is about to spend $500,000 on equipment. C. P. Huntington is said to be interested.

LEVIS, QUE.—See Scrap item "Dominion Railroad Appropriations" on another page.

MONTEREY, N. MEX.—Vincente Ferrara, of Monterey, President of the company building an iron foundry at this place, is reported to be in the United States, buying machinery for the plant.

J. A. Robertson, of this city, is reported to have secured sufficient capital to build a smelting plant in Monterey. A company with acapital of $1,000,000, has been organized. Considerable machinery and other material will be wanted.

MONTREAL, QUE.—Bids are wanted by Joseph R. Roy, Secretary of the Department of Public Works of Canada, at Ottawa, until July 20, for building a high-level pier and bulkheads in the lower part of Montreal harbor. Plans and specifications can be seen at his office. A check for $50,000 must accompany each bid.

NASHVILLE, TENN.—The contract for the new freight depot for the Nashville terminals of the Louisville &

Nashville is let to the Angus-Gindle Co., of Chicago, Ill. The building will be divided into an incoming and outgoing depot, the latter being about 500 ft. long, and the former 425 ft. long.

NEVAD, IOWA.—The Chicago & Northwestern will build a new depot in this place, costing about $15,000.

ST. LOUIS, MO.—The Mobile & Ohio R. R., we are informed, has under consideration building a new freight depot at East St. Louis. Nothing definite is decided.

WICHITA, KAN.—H. J. Walleau, of Jefferson City, Mo., not St. Louis as recently stated, has the contract for the passenger station and office building of the Missouri Pacific Ry. in Wichita.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad associations and engineering societies see advertising page xi.)

National Association of Railroad Agents.

The fourth annual convention of the National Association of Railroad Agents will be held in Detroit, July 24 to 27. W. D. Wilson, of Indianapolis, is President. Two or three excursion trips have been arranged for the entertainment of the delegates to this convention.

Western Society of Engineers.

The Western Society of Engineers visited the controlling works of the Drainage Canal near Lockport, Ill., on Saturday, June 30. There were about 225 in the party, which was taken down the channel in boats. The raising and lowering of the bear trap dam and sluice gates was witnessed, and on the return a special Santa Fe train was taken at Romeo.

PERSONAL.

(For Other personal mention see Elections and Appointments.)

—Mr. Walter H. Lindley, Superintendent of Dining Cars of the Lake Shore & Michigan Southern, at Chicago, Ill., died July 2.

—Mr. D. J. Casey, Chief Engineer of the Detroit & Mackinac, died at Phoenix, Ariz., June 29. He was formerly Assistant Chief Engineer of the Michigan Central.

—Mr. J. T. Connelly, Superintendent of the tank department of the American Car & Foundry Co., was found dead in a hotel where he boarded in Philadelphia July 5. He was about 70 years old.

—Mr. John H. Hamilton, General Superintendent, and Mr. E. LaLime, Master Mechanic of the Ohio River R. R., were instantly killed at Parkersburg, W. Va., on July 4, in an accident, which is reported in another column.

—Mr. Charles R. Tunks, Master Car Builder of the Lake Shore & Michigan Southern, who died very suddenly on Friday, June 29, at Toledo, Ohio, was 50 years of age and had been in the service of that company for 35 years.

—Mr. Charles A. Higgins, Assistant General Passenger Agent of the Atchison, Topeka & Santa Fe, died at his home in Chicago, Ill., on July 4. He was born in Massachusetts 41 years ago and has been connected with the Santa Fe road for about 20 years.

—Mr. George F. Gage, for many years General Manager of the Huntingdon & Broad Top Mountain, died July 5. He is credited with doing much toward developing the line as a coal road. The son, Mr. C. M. Gage, is the present General Manager of this company.

—Prof. William G. Raymond, of the Rensselaer Polytechnic Institute, was, on June 6, appointed Consulting Engineer to the Commissioner of Public Works at Troy. He has especial oversight over planning and building works for additional supply of water. The works, as projected, will be quite extensive.

—Hon. J. Pope Brown was, on July 2, appointed a member of the Georgia Railroad Commission, succeeding the late Col. L. N. Trammell. Mr. Brown is a graduate of Mercer University, Macon, Ga. He is President of the State Agricultural Society and is interested, not only in farming but also in manufacturing, and has represented his district in the Legislature.

—Mr. J. G. Robinson, late of the Waterford, Limerick & Western Railway of Ireland, has been appointed Locomotive Superintendent of the Great Central Railway of England, in place of Mr. Harry Pollitt, whose resignation was noted in the *Railroad Gazette* of June 22, p. 453. Mr. Robinson began his railroad career on the Great Western, under Mr. Armstrong, working later under Mr. William Dean. He went to Ireland in 1884 and has been Locomotive Superintendent of the W. L. & W. for the past 11 years.

—Mr. Julius F. Pratt, Vice-President and Treasurer of the Atlas Engine Works of Indianapolis, died July 7 at Glengariff, Ireland. Mr. Pratt was born in Worcester, Mass. He went West and settled in Indianapolis. He entered the employ of the Woodburn-Sarvem Wheel Co., and later became one of its proprietors. When this concern was absorbed by the American Wheel Co. Mr. Pratt was elected President. Afterward he became interested in the concern of which he was an officer at the time of his death. He was a Director of banks and other corporations.

—Mr. C. Murphy, Superintendent of the Chapleau Division of the Canadian Pacific, was born in Prescott, Ont., Nov. 20, 1865. He entered the service of the old Montreal Telegraph Co. as a messenger in May, 1879. Four years later, in July, he entered the service of the Canadian Pacific as night operator at Hull. He has remained with the company until the present, serving as chief operator at Ottawa since February, 1885; as Dispatcher from August, 1885; as Chief Train Dispatcher from May, 1890; as Acting Superintendent of the Chapleau Division from August, 1899, and as Superintendent for the same division since June 11, 1900.

—Mr. G. E. Evans is the new General Manager of the Louisville & Nashville. He was born at Cambridge, Ohio, May 2, 1856, and entered the service of the Baltimore & Ohio as a telegraph operator in 1871. He was appointed to a similar position with his present company, the Louisville & Nashville, in September, 1873, and has since then remained with that company. He was appointed Chief Operator and Train Dispatcher of the Louisville division in 1880; Master of Trains the same division, 1882, and Superintendent of the division in January, 1885. He was appointed Superintendent of Transportation of the system May 17, 1886, which position he held until his recent advancement.

—Mr. M. S. Dean's appointment as General Manager of the Butte, Anaconda & Pacific at Anaconda, Mont., has been already noted in these columns. Mr. Dean has had nearly 14 years' experience in railroad service. Seven of these were spent with the Chicago, St. Paul, Minneapolis & Omaha at Mankato, Minn., and at St. Paul. He began service with that company at stenographer in the office of the Division Superintendent, and later became corresponding and confidential clerk. For four years prior to his recent appointment he served with the Ohio River Railroad. For more than two years he was Acting Purchasing Agent and then for a few months Purchasing Agent. He also assumed the duties of Assistant to the General Manager.

—Mr. Ira C. Hubbell, Purchasing Agent of the Kansas City, Pittsburgh & Gulf and the reorganized company, the Kansas City Southern and allied interests, has resigned, to take effect July 31. He will become President of the Locomotive Appliance Company, Chicago, which company has been formed especially to put a new form of valve gear on the market. Mr. Hubbell entered railroad service when a boy and continued in railroad work until 1883, when he became Manager of the St. Louis branch of Fairbanks, Morse & Co., which position he held for six years. He was then transferred to Kansas City, and there held a similar place until 1896, when he was made Purchasing Agent of the Kansas City, Pittsburgh & Gulf. Mr. Hubbell's experience as both a buyer and seller fits him well for his new work.

—Mr. R. J. E. Chapple, whose appointment as Division Superintendent at Schrieber, Ont., for the Canadian Pacific was recently noted, was born in Plymouth, England, March 15, 1862. His first railroad service was in the office of the Division Engineer of the Cromwell line of the Great Western of England in 1876. In July, five years later, he was appointed a clerk in the accountant's office of the Grand Trunk, and a month later was transferred to the fuel agent's office. He entered the service of his present company, the Canadian Pacific, March 26, 1882, and has served since that time as stenographer to the Assistant General Superintendent since 1883; as Chief Clerk to the Vice-President since 1892; as General Superintendent's assistant on the Eastern Division since April, 1894, and Division Superintendent at Schrieber (his present position) since June 18, 1900.

—Mr. W. G. Coughlin on July 1 became Principal Assistant Engineer of the Philadelphia & Erie and the Northern Central lines at Williamsport, Pa. Mr. Coughlin was born in Florence, N. J., in 1862, and educated at the Farnum School, Beverly, N. J. In 1876 he went to Brazil, as rodman on the engineering corps of the Madeira & Mamore Ry., building by P. & T. Collins. During the summer of 1879 he was employed on private surveys under the direction of Mr. C. S. D'Invelliers in Pennsylvania. He entered the Construction Department of the Pennsylvania Railroad in the fall of the same year, and was located at various points east of Pittsburgh on preliminary location and construction work. In March, 1883, he was transferred to the Maintenance of Way Department of the Northern Central and appointed Assistant Supervisor at Baltimore. He was promoted in 1886 to Supervisor of Section 3 on the West Jersey, with headquarters at Millville, N. J., and was transferred to Section No. 1 in 1891 at Woodbury, N. J. On March 1, 1893, he was made Assistant Engineer of the Baltimore Division, with office at Baltimore, and held that position until his advancement on July 1.

ELECTIONS AND APPOINTMENTS.

American Refrigerator Transit Co.—L. D. Voak, Superintendent, having resigned, J. F. Dedderick has been appointed Acting Superintendent, effective July 1.

Boston & Maine (Fitchburg).—The property of the Fitchburg was, on July 1, leased to the B. & M., and the officers of the Fitchburg will, until otherwise directed, continue to perform their respective duties.

Cane Belt.—In addition to his duties as General Freight and Passenger Agent, Charles Boedeker will also assume those of Assistant to General Manager. Auditor F. J. Huey will also assume the duties of Secretary and Treasurer.

Chicago & Alton.—The report extensively circulated that S. R. Knott, who recently resigned as Vice-President of the Plant System, had been elected Vice-President of the C. & A., we are informed, is incorrect.

Chicago & Northwestern.—F. G. Benjamin has been appointed Master Mechanic of the Northern and Western Iowa Divisions, succeeding J. F. Fleischer, transferred as Master Mechanic of the Ashland Division, succeeding A. W. McLean, resigned. S. C. Graham has been appointed Master Mechanic of the Iowa and Minnesota Division, with headquarters at Belle Plain, Ia.

Chicago Great Western.—Burton G. Saunders has been appointed General Eastern Agent, succeeding C. H. Adair, deceased, effective July 1.

Chicago, St. Paul, Minneapolis & Omaha.—The St. Paul & Sioux City Division will be known as the Minnesota & Iowa Division, and L. F. Slaker has been appointed Superintendent of this Division, with headquarters at St. James, Minn., succeeding H. Spencer, resigned. The Northern and Eastern Divisions have been consolidated and will hereafter be known as the Wisconsin Division and W. C. Winter has been appointed Superintendent of this Division, with headquarters at St. Paul, Minn., effective July 1.

Chesapeake & Western.—DeWitt Smith is President, W. H. Hall Treasurer and Comptroller, and J. C. Ward, Secretary and Auditor of this company.

Choctaw, Oklahoma & Gulf.—G. H. Lee, heretofore Chief Clerk Passenger Department, has been appointed General Passenger Agent.

Colorado & Northwestern.—W. A. Dixon has been appointed Auditor, with headquarters at Boulder, Colo., succeeding S. D. Hum, resigned.

Colorado Midland.—At a meeting of the stockholders, held July 2, Frank Trumbull was elected President, succeeding Geo. W. Ristine, resigned, and D. C. Dodge, Vice-President, succeeding B. Aymar Sands, resigned.

Copper Range.—At the annual meeting of this company W. A. Paine was elected President, succeeding J. H. Seager, resigned; J. H. Rice was elected Vice-President and C. W. Sanders was appointed Chief Engineer, succeeding Thos. Appleton, resigned.

Cornwall.—W. H. Hill has been appointed Master Mechanic, with headquarters at Lebanon, Pa.

Direct Navigation Company (Southern Pacific).—B. C. Cushman has been elected Secretary and Treasurer.

Erie & Wyoming Valley.—D. E. Barton, Master Mechanic at Dunmore, Pa., has resigned.

Grand Trunk.—Dr. J. Alex. Hutchison has been appointed Chief Surgeon of the lines west of the Detroit and St. Clair Rivers, with headquarters at Montreal, Que., succeeding Dr. T. W. Miller, deceased.

Iowa Central.—G. D. Brooke has been appointed Master Mechanic and Master Car Builder, succeeding B. Reiley, resigned.

Kansas City Southern.—Ira C. Hubbell, Purchasing Agent, with headquarters at Kansas City, Mo., has resigned, effective July 31.

Lake Shore & Michigan Southern.—Owing to the death of C. R. Tunks, the position of Division Master Car Builder at Adrian, Mich., has been abolished and the jurisdiction of L. G. Parish, Division Master Car Builder at Chicago, has been extended to include the entire Michigan Southern Division. Effective July 9.

Louisville & Atlantic.—George MacLeod, General Manager, has resigned and C. M. Browning, General Freight and Passenger Agent, has been appointed to succeed Mr. MacLeod, with the title of Superintendent.

Louisville & Nashville.—C. B. Phelps has been appointed Superintendent of Transportation.

J. L. Welch, heretofore Assistant Division Superintendent at Birmingham, Ala., has been appointed to succeed Mr. Phelps, as Assistant Division Superintendent at Nashville, Tenn.

Missouri Pacific.—E. J. Ward has been appointed Division Superintendent, with headquarters at Wichita, Kan., succeeding W. E. Tracy, transferred.

Mobile & Ohio.—B. M. Flippin has been appointed General Export Agent, with headquarters at Mobile, Ala., assuming the duties heretofore discharged by Assistant General Traffic Manager, C. W. Gibson. Mr. Flippin is also appointed Traffic Manager of the Mobile Docks, succeeding Mr. Gibson. Effective Aug. 1.

Norfolk & Southern.—R. D. Whitehorn has been appointed General Foreman, succeeding R. P. Schilling, resigned.

Ohio River.—Owing to the death of J. H. Hamilton, General Superintendent, and E. La Lime, Master Mechanic, F. E. Blaser has been appointed Superintendent, with headquarters at Parkersburg, W. Va., and W. W. Layman, Acting Master Mechanic, effective July 4.

Oregon R. R. & Navigation.—D. W. Campbell has been appointed Assistant Superintendent, with headquarters at Starbuck, Wash. This is a new position, M. J. Buckley, the other Assistant Superintendent, being transferred to the Oregon Division.

Pennsylvania.—Newspaper reports state very definitely that a reorganization of the Allegheny Valley and the Western New York & Pennsylvania will be effected about Aug. 1, to be known as the Buffalo & Allegheny Division, with G. W. Creighton, General Superintendent of the Northern Central, in charge of the new Division, with headquarters at Buffalo, N. Y. H. S. Laird has been appointed Supervisor, with headquarters at Lewistown, Pa., succeeding R. H. Myers, deceased.

Seaboard Air Line (Florida Central & Peninsular and Georgia & Alabama).—The jurisdiction of the General Offices of the S. A. L. have been extended over the two systems (F. C. & P. and G. & A.) recently absorbed by the S. A. L. The following Division Superintendents have been appointed: J. M. Turner, in charge of the Second Division, with headquarters at Hamlet, N. C.; Cecil Gabbett, in charge of the Fourth Division, with headquarters at Savannah, Ga., and D. E. Maxwell, in charge of the Fifth Division at Jacksonville, Fla., effective July 1. T. W. Roby has been appointed Comptroller, with headquarters at Portsmouth, Va.

Union Pacific.—S. A. Hutchison, Assistant General Passenger Agent at Omaha, Neb., has resigned.

Virginia-Carolina.—The officers of this company are: President and General Manager, W. E. Mingie; Vice-President and Treasurer, G. F. Craig; Secretary, F. B. Hurt, and Auditor, G. T. Kearsley. (See R. R. Construction column, Feb. 2, p. 80.)

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ATLANTIC COAST LINE.—Options are reported being obtained on tracts of land near Emporia, Va., for reducing curves north of that city.

ARIZONA & NEW MEXICO.—The citizens of El Paso, Tex., have offered this company $50,000 to extend its line from Lordsburg, N. Mex., east about 150 miles to that city. Arrangements are being made for widening the line to standard gage, preparatory to extending it east about 65 miles to Deming, on the Southern Pacific.

BANGOR & AROOSTOOK.—An officer writes that the company has no plan for building a branch from Greenville Junction, Me., to Greenville, and there are no charter rights for such a branch. (June 29, p. 458.)

BATON ROUGE, HAMMOND & EASTERN.—Surveys are to be made at once, according to report, on this line from Baton Rouge, La., east about 45 miles to Hammond, and thence to Gulfport. W. R. Watson, of Hammond, La., is President. (June 22, p. 433.)

BERKLEY & SOUTH NORFOLK RAILROAD & TERMINAL.—This company was incorporated in Virginia, July 5, with a capital stock of from $5,000 to $10,000, to build railroads and do a general storage and transportation business in Berkley and South Norfolk. The officers are: President, W. W. Tunis; Vice-President, W. L. Berkley; Secretary and Treasurer, Matt M. Tunis.

BIRMINGHAM, SELMA & NEW ORLEANS.—Final surveys are reported in progress on the extension from Martins, Ala., about 40 miles, west to Lyndon. (May 4, p. 295.)

BURLINGTON, CEDAR RAPIDS & NORTHERN.—Bids for grading will be let next week on an extension of the main line from Albert Lea, Minn., north 48 miles to

Faribault, which will bring the road to within about 50 miles of St. Paul.

CHICAGO & NORTHWESTERN.—Surveys are reported completed to Juneau, on the extension from Waukesha, Wis., to run northwest 30 miles through Juneau to Beaver Dam. (June 15, p. 407.)

CHICAGO, RIVER FOREST & WESTERN.—This company was incorporated in Illinois, July 3, with a capital stock of $50,000, to build a railroad in Cook County from Chicago west to Melrose Park. The incorporators and first board of directors are: Stewart Spaulding, R. L. Davis, William A. Rawson, Albert Peterson and Isaac Bassford, all of Chicago.

DAKOTA & GREAT NORTHERN.—This company has been incorporated by officers of the Great Northern, with a capital stock of $2,500,000, to build a line in North Dakota, from Lakota northwest about 75 miles to a point on the International boundary in the counties of Cavalier or Towner: also from Bottineau northwest about 35 miles.

DAKOTA PACIFIC.—An officer writes that bids are being received now and contracts will be let in 30 days for completing 32 miles of grade and laying the track on the line from Rapid City, S. Dak., west to Mystic. Wm. T. Coad, of Rapid City, is President. (June 22, p. 434.)

DANVILLE, PAXTON & NORTHERN.—Right of way is being secured for this line in Illinois from the south line of Vermillion County northeast through Danville and Paxton to the north line of Floyd County. A. C. Daniel, of Danville, is President and General Manager. (Jan. 5, p. 14.)

DAVENPORT, ROCK ISLAND & NORTHWESTERN.—All the right of way is reported obtained for the extension from Davenport, Iowa, east to East Moline, Ill. (April 20, p. 263.)

DES MOINES & NORTHERN IOWA.—Surveys have been completed between Boone, Iowa, and Britt, 76 miles, and nearly all the right of way secured. The surveyors are now at work on the extension to Des Moines. The road, as projected, is from Boone north 158 miles to Wells, Minn., and building is to be begun as soon as right of way is secured. (May 4, p. 295.)

DULUTH & NEW ORLEANS.—An agreement has been made with Nevada Township, Iowa, whereby a vote will be taken, Aug. 1, for a 3 per cent. tax in aid of the road. Building is in progress between Des Moines and Osage. S. V. Wardall, of Ames, Iowa, is President. (May 18, p. 329.)

EASTERN & NORTHWESTERN.—Surveys are reported in progress for this line from Benton Harbor, Mich., to run east about 160 miles to a point on Lake Erie. The principal office is Benton Harbor, Mich. J. C. Caldwell and Oakley Curry are among the incorporators. (April 6, p. 227.)

GOBLE & NEHALEM.—Building is reported begun on this logging line from Goble, Ore., on the Northern Pacific, to run south to Nehalem Bay, on the Pacific ocean. E. Cannon, of Portland, Ore., is an incorporator. (May 20, p. 263.)

GREAT NORTHERN.—Locating surveys are reported completed for the proposed Dakota & Great Northern branch (see above) from Bottineau, N. Dak., northwest 35 miles to a new town to be called Richberg. (June 8, p. 380.)

The city of Everett, Wash., has granted right of way to the company over streets of the city.

ILLINOIS CENTRAL.—The company is building 20 miles of extension from Tutwiler, Miss., north to Lake Cormeraut, 21 miles south of Memphis, and has located 45 miles additional. J. N. Darling, at Tutwiler, Miss., is in charge of the work. (Oct. 6, 1899, p. 701.)

IOWA CENTRAL.—Work is begun on several improvements in the city of Oskaloosa, Ia. A new main track is being built to replace a short curve about two blocks north of the station. New coal chutes are being built and the old Central Hotel remodeled into a freight depot and office building.

JAMESTOWN MANUFACTURERS' TERMINAL.—This company was incorporated in New York, July 5, with a capital stock of $50,000, to build a steam railroad 2½ miles long at Jamestown. The directors are: William Endress, Samuel Briggs and Julius D. Frick, of Jamestown.

KANSAS CITY, LIBERTY & ELDON.—This company was incorporated in Missouri, June 30, with a capital stock of $1,000,000, to build a railroad from Kansas City northeast about 30 miles via Liberty to Excelsior, in Clay County. The incorporators are: Christopher B. Leavel, Wm. O. Thomas and H. G. Port.

LEHIGH VALLEY.—The company is building the Greenville & Hudson, which is to be completed by the end of July, a double track road completing the link of the main line through Jersey City. It is to run from Constable Junction, Greenville, through Jersey City, to a point near Johnston avenue, on the L. V. terminal property at the water front, the total length being 13,750 ft. (2.6 miles). Building was begun about four years ago and 1,729 ft. of double track laid from Jersey City terminal west to Communipaw avenue. After the ordinance was passed last winter, the company took up the building. The maximum grade is 0.75 per cent.; the maximum curve is 3°. There are five iron bridges and about 6,000 ft. of double track timber trestling, all completed. The rails are second-hand relaying rails. (Official.)

LITTLE ROCK & HOT SPRINGS WESTERN.—Building is reported begun on the three-mile branch from Beauxite Station, Ark., into the beauxite fields. (March 30, p. 210.)

LYNCHBURG & WARTRACE.—Final details are reported completed for building this line from Wartrace, Tenn., on the Nashville, Chattanooga & St. Louis, to run south about 15 miles to Lynchburg. John Y. Garlington, of Lynchburg, is General Manager.

LYNN CANAL SHORE LINE.—This company was incorporated in Washington June 28, with a capital stock of $100,000, to build a railroad in Alaska from a point near the mouth of Skaguay River, on the Lynn Canal, to run northwest to the mouth of the Dyea River, about seven miles. The principal office is Seattle, Wash.

MOBILE, JACKSON & KANSAS CITY.—Building is to be begun at once on the extension from Merrill City, Miss., northwest about 133 miles, via Laurel, Raleigh and Brandon, to Jackson. C. D. Smith & Co., Birmingham, Ala., have the contract for a part of the line. (June 22, p. 434.)

MONTANA ROADS.—The Butte Mercantile Co. has been granted right of way along Iron street, in Butte, to connect its plant with the Butte, Anaconda & Pacific.

NORTHERN PACIFIC.—Contracts are reported let for the branch from Arlington, Wash., to run east about 30 miles to Darlington. (June 1, p. 364.)

The company is reported building the extension of its spur line from Portage la Prairie, Man., north to Lake Manitoba. Nine miles was completed last year. (Nov. 3, 1899, p. 769.)

OHIO RIVER & SMITHFIELD.—This company has been incorporated in Ohio, with a capital stock of $10,000, to build a railroad from Rush Run, on the Cleveland & Pittsburgh line of the Pennsylvania Co., to run west about 10 miles to Smithfield. The incorporators are: R. G. Richards, C. P. McFadden, J. A. Moore, J. S. Paisley and J. A. Armstrong, of Steubenville, O.

PENNSYLVANIA.—Bids are asked for an extension of six miles to the Evansburg & Black Lick Creek R. R.; also for 1½ miles on the branch of the Hempfield R. R. to Hermini. Both branches are to new coal fields in Pennsylvania.

PITTSBURGH, CONNELLSVILLE & WHEELING.—The company gives notice that it is ready to receive bids for the West Virginia section of this line, which is to run from Connellsville, Pa., west about 50 miles to Wheeling. Edgar A. Holmes, of Wheeling, W. Va., is General Manager. (March 9, p. 161.)

PRINCETON & WISCONSIN RIVER.—This company was incorporated in Wisconsin, July 3, with a capital stock of $750,000, to build a railroad from Princeton west about 50 miles through Juneau, Adams, Marquette and Green Lake Counties to Necedah, both terminal points on the Chicago & Northwestern. The incorporators are: R. A. Crandal, Robert Jones, W. H. Hopkins, W. S. Syrett and John C. Hopkins, of Chicago.

ST. LOUIS, IOWA & DAKOTA.—Another survey is to be made from Sioux City, Iowa, south towards St. Louis. A portion of the proposed right of way was built upon by the Soldier Valley line of the Chicago & Northwestern. T. P. Gere, of Sioux City, Iowa, is President. (Oct. 13, 1899, p. 719.)

SILVERTON, GLADSTONE & NORTHERN.—Ties and rails are reported ordered for an extension of four miles north from Gladstone, Colo. The road was built in 1899 from Silverton to Gladstone, nine miles. (July 28, 1899, p. 548.)

SOUTH BUFFALO.—Lathrop & Shea, of New Haven, Conn., have the contract for this line six miles long in the city of Buffalo, N. Y., for the Lackawanna Iron & Steel Co. (July 6, p. 472.)

SOUTHERN PACIFIC.—The Ogden & Lucin R. R. Co. was incorporated in Utah June 26, with a capital stock of $1,000,000, to build the proposed cut-off in Northern Utah across the north arm of Salt Lake to Ogden, 107 miles. (July 6, p. 472.)

Surveys are reported in progress for an extension from Kelton, Utah, northwest into the Silver Lake country in Idaho.

TENNESSEE CENTRAL.—A number of surveys are in progress in Cumberland County, Tenn., for short branches and spurs from the main line to coal fields. Jere Baxter, Nashville, Tenn., is President.

TEXAS ROADS.—Henry Landa, of New Braunfels, is reported making arrangements with the State Railroad Commission to build a railroad from New Braunfels, on the International & Great Northern, to run south eight miles to Marion, on the Southern Pacific.

John W. Maxcy, of Houston, Tex., is making a survey for the state road from the Brazos river to the Bernard River. (March 30, p. 210.)

THE DALLES SOUTHERN.—Surveys are reported in progress on this line from The Dalles, Ore., to run along the east slope of the Cascades, 30 miles to Lakeview. E. E. Lytle, President of the Columbia Southern, is President. (March 16, p. 177.)

UNION PACIFIC.—Owen Bros., of Norfolk, Neb., have taken the contract for removing a hill east of Fort Steele, Wyo., for a proposed cut-off. They will also build about three miles of grade for double track near Edson station, 20 miles east of Fort Steele.

VIRGINIA ROADS.—N. B. Dotson, of Wise, Va., confirms the statement that he is to build a railroad 20 miles long in Wise County. It is to run from Wise west through a 50,000 acre tract of coking and steam coal lands, and will probably connect with the Norfolk & Western and the Louisville & Nashville. (July 6, p. 472.)

WHITEHALL & GRANVILLE.—Bids are asked, until July 20, at 2 p. m., for building and equipping this proposed electric line from Whitehall, N.Y., southeast to West Pawlet, Vt., with a branch from Granville to Lake St. Catherine and South Poultney, Vt., 20.14 miles in New York and 8.41 miles in Vermont, besides 5.07 miles of spur and sidings. Charles I. Baker, 10 Hall Bldg., Troy. N. Y., can furnish the particulars. See our advertising columns.

GENERAL RAILROAD NEWS.

ALGOMA CENTRAL.—This company is reported to have obtained running rights over the International R. R. bridge, and will run its cars over the lines of the Michigan Lake Superior Power Co. to Sault Ste. Marie, Mich. The company is building on the Canadian side.

ATCHISON, TOPEKA & SANTA FE.—With reference to the bond issue it is announced that $3,390,000 of 4 per cents. are authorized, of which $2,130,875 are for branch lines and extensions; $275,395 toward the acquisition of the Atlantic & Pacific; $253,235 to retire equipment bonds; $631,338 for special improvements on the Santa Fe Pacific; $43,882 for improvements on the general property, and $58,000 to retire certain bonds. (June 15, p. 408.)

The property of the Chicago, Santa Fe & California, a subordinate company, has been conveyed to the parent company and brought under the general mortgage of 1895.

BOSTON ELEVATED.—The State Board of Railroad Commissioners has granted the petition of the company for an additional issue of $9,500,000 capital stock, of which $3,100,000 is for building and equipping, including foundations, track and electric system; $1,200,000 for equipment of terminal and other stations, exclusive of lands; $50,000 for equipment of subway; $1,100,000 for equipment of power houses, exclusive of land; $600,000 for rolling stock and its equipment; $300,000 for engineering and miscellaneous expenses during the building of extensions, and $3,150,000 for real estate and the payment of damages.

BUFFALO & SUSQUEHANNA.—Holders of first mortgage 5 per cent. gold bonds are notified that the sum of $79,735.85 is available for purchase of these bonds up to July 31, at not to exceed part and accrued interest, by Harvey Fisk & Co., New York. (Aug. 18, 1899, p. 590.)

CHATTANOOGA & DURHAM.—This line, which runs from Chickamauga, Ga., to Durham, 17.34 miles, was taken over July 7 by the Chattanooga, Rome & Southern.

CHICAGO & GRAND TRUNK.—Judge Swan, in the U. S. Circuit Court, at Detroit, on June 28, ordered the receiver, on July 1, to discontinue operation under the leases of the Cincinnati, Saginaw & Mackinaw and the Toledo, Saginaw & Muskegon. This order is on the ground that the roads are detrimental to the operating company. They will be operated by the Grand Trunk. (July 6, p. 472.)

CHICAGO & NORTHWESTERN.—N. W. Harris & Co. are offering for sale $3,344,000 of 3½ per cent. additional bonds at 101⅝, making the interest rate 3.4 per cent.

CHICAGO, BURLINGTON & QUINCY.—Sealed proposals will be received until noon, July 14, for the sale of Denver extension 4 per cent. bonds to absorb the sum of $85,738.37, interest to cease July 16. (July 6, p. 472.)

COSHOCTON & SOUTHERN.—The Wheeling & Lake Erie has taken control of the property, which has been repaired and is now in operation. (April 6, p. 228.)

FONDA, JOHNSTOWN & GLOVERSVILLE.—Permission has been granted to issue $1,500,000 new bonds to retire existing bonds. (June 29, p. 458.)

KANSAS CITY & NORTHERN CONNECTING.—Judge Thayer, in the U. S. Circuit Court, at St. Louis, on July 2, denied the application of Eastern stockholders for the removal of Charles H. Cnappell and James Hopkins, as the receivers of this company and the Omaha & St. Louis. Decision was reserved on the question of rescinding the Judge's orders that the Omaha & St. Louis borrow $525,000. (June 22, p. 434.)

KANSAS CITY, PITTSBURGH & GULF.—Holders of the various securities are notified that they can exchange their certificates of deposit on and after July 16 into the securities of the Kansas City Southern. (May 4, p. 296.)

MEXICAN NATIONAL.—Twenty-seven second mortgage A and B 6 per cent. subsidy bonds of 1882 have been drawn for payment at par under the deed of Sept. 1, 1888. They are payable to Matheson & Co., London, after July 13, at $1,310, of which the $310 represents accrued interest on A bonds. Certificates not presented for redemption before Aug. 31 will lose the benefit of the trust deed. (April 6, p. 228.)

NEW YORK & HARLEM.—Proceedings have been brought in the New York Supreme Court in behalf of the Continental Insurance Co., the Westchester Insurance Co., and the Rhode Island Hospital Trust Co., and other stockholders whose holdings aggregate about 3,000 shares, against the New York & Harlem and the New York Central with reference to obtaining the benefits of the refunded $12,000,000 5 per cent. consolidated bonds. They claim that an additional $220,000 per annum is due the stockholders. (May 25, p. 348.)

NEW YORK & OTTAWA.—Judge Lacombe, in the U. S. Circuit Court, has denied the application of John L. Herning to intervene in the suit in equity against the railroad company of Allanson T. Enos, on whose application the receiver was recently appointed. (May 4, p. 296.)

NORTHERN OF NEW JERSEY.—The company has filed a new general mortgage to secure $1,000,000 4½ per cent. bonds, due Jan. 1, 2000. The U. S. Trust Co., of New York, is trustee. (July 14, 1899, p. 516.)

OMAHA & ST. LOUIS.—See Kansas City & Northern Connecting.

PEORIA & PEKIN TERMINAL.—The capital stock has been increased from $500,000 to $700,000. (May 18, p. 330.)

PEORIA, DECATUR & EVANSVILLE.—Marcus Mayer, New York, a stockholder, has filed a petition in the U. S. Circuit Court at Springfield, Ill., asking that the decree of foreclosure and sale be set aside on the ground that certain properties were not included in the sale. (July 6, p. 472.)

ST. CLAIR, MADISON & ST. LOUIS BELT.—Judge Adams, of the United States District Court, at St. Louis, on June 22, granted the receiver, J. S. Barnard, permission to expend $35,000 on the Alton bridge, subject to the approval of the U. S. Circuit Court for Southern Illinois. The road went into the hands of the receiver Jan. 15, 1897. (Jan. 22, 1897, p. 72.)

ST PAUL & DULUTH.—The Manhattan Trust Co. will distribute to holders of syndicate certificates as their share of the proceeds of the sale of the property to the Northern Pacific and the installment paid by them on the certificates, a sum equal to 31 per cent. of the full amount subscribed. The total subscription was $7,000,000, of which $1,750,000 was paid in. (July 6, p. 472.)

SEABOARD AIR LINE.—At the meeting, held on June 30, necessary steps were taken for the taking over of some six or seven individual roads in addition to the Georgia & Alabama and the Florida Central & Peninsular, aggregating more than 600 miles. The earnings since July 1 are being consolidated with the main system. It is announced that more than 80 per cent. of the capital stock of the Georgia & Alabama has assented to the plan of consolidation and the stock of that company will be retired and replaced by new securities of the Seaboard system. (July 6, p. 472.)

SOUTHERN.—Fifty-one Richmond & Danville equipment mortgage bonds of Sept. 3, 1899, have been drawn for the sinking fund, with coupons maturing Sept. 1, to be paid on that date at par. (June 29, p. 458.)

TOLEDO, ST. LOUIS & WESTERN.—This company was incorporated in Ohio, July 9, with a capital stock of $20,000,000, to take over the reorganized Toledo, St. Louis & Kansas City. The incorporators are: James N. Wallace, Arthur H. Van Brunt, Henry J. Bigham, J. Edwards Wyckoff, Frederick M. Brown, Henry E. Mattison, Charles Flynn, Wm. H. Fain, Lewis H. Freedman, Grant Notman and Albert Rathbone.

WESTERN NEW YORK & PENNSYLVANIA.—This property is to be taken over by the Pennsylvania about Aug. 1. It is to be operated by the Pennsylvania proper, except a small portion between New Castle, Pa., and Oil City, which will be operated by the Pennsylvania Co. as part of the Erie & Ashtabula Division. It will probably be consolidated with the Allegheny Valley. (June 15, p. 408.)

WHITE & BLACK RIVER VALLEY.—The lease of this property was ratified by its stockholders and directors on June 29, and possession given to the Choctaw, Oklahoma & Gulf on July 1. The line runs from Brinkley, Ark., to Jacksonport, 58 miles, and from Wiville to Gregory, six miles. (June 8, p. 380.)